State of California
The Resources Agency
Department of Water Resources

Draft Final Report SP-T1: Effects of Project Operations and Features on Wildlife and Wildlife Habitat

Oroville Facilities Relicensing
FERC Project No. 2100

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FERC Project No. 2100

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Several individuals from various organizations and agencies provided significant contribution to this study plan including Amy Lyons (DFG), Audrey Silbernagel (DFG), Mara Kraemer (DFG), Tom Boullion (DWR), and Dr. Don Anthrop (California State University San Jose and California Waterfowl Association) who participated in waterfowl nest surveys. Mark Henley (California Waterfowl Association) and Dr. Anthrop worked with DWR Operations staff to design and monitor a successful 2003 experimental Afterbay reoperation designed to minimize losses of waterfowl nests and eggs. Aric Lester (DWR) provided the graphics associated with Feather River stage/discharge modeling. Ryan Martin (DWR) and Tom Boullion were responsible for the bulk of the wildlife data collection utilized in this report

REPORT SUMMARY

In addition to meeting Federal Energy Regulatory Commission (FERC) guidelines, the information provided in this report is required for compliance with State and federal environmental regulations including: the California Environmental Quality Act (CEQA), National Environmental Policy Act (NEPA), California Endangered Species Act (CESA), Federal Endangered Species Act (FESA), Federal Power Act (FPA), and the Federal Migratory Bird Treaty Act (MBTA).

Study objectives included identification of on-going and potential future project-related effects on wildlife and wildlife habitat, to provide information that could be used to identify potential protection, mitigation, and enhancement measures and to identify species trade-offs associated with management and operation of project facilities.

Evaluations within this study identified potentially significant impacts to wildlife populations and wildlife habitat related to current and future project operations and maintenance. Analyses within the study identifies opportunities to enhance, minimize, avoid, or mitigate these potentially significant impacts through implementation of Resource Actions within the Settlement Agreement process or conservation measures within the federal ESA Section 7 consultation process.

Water Level Fluctuations-Lake Oroville

Loss of soil to wave action, periodic inundation; followed by severe desiccation have resulted in a generally barren drawdown zone within Lake Oroville. Lack of vegetative cover within the drawdown zone severely limits wildlife use of this area. Thirty-six wildlife species were detected in limited numbers during field surveys using habitats within the drawdown zone.

Feather River Flow Fluctuations

Bank swallow, a State listed Threatened species, nest colonially in burrows within eroding cut banks along the Feather River downstream from the project area. These nesting locations are particularly susceptible to changes in project releases. To evaluate the potential for project-related inundation of pre-fledged nestlings, stage discharge relationships were modeled for each 2003 active colony locations. These stage/discharge relationships were compared to the elevation of the lowest burrow in each colony with a 1-foot buffer. This modeling indicates that 2003 project operations during early July had the potential to inundate at least a portion of nine of the fifteen active colonies while pre-fledged young are potentially present within the nest burrows. However, it is currently unknown if any of the potentially inundated burrows contained nestlings at the time of inundation. The Department of Water Resources (DWR) is currently consulting with the California Department of Fish and Game (DFG) to design avoidance and minimization measures for bank swallows for compliance with the CESA.

Project operations may serve to limit the establishment and maintenance of riparian habitat on the Feather River. Cottonwood-willow riparian habitat support more breeding avian species than any other comparable broad habitat type in California (Gaines 1977). Quantification of project related loss of riparian habitat is being conducted under Relicensing Study SP-T3/5 and may result in development of Resource Actions to address the wildlife habitat losses associated with this currently unquantified impact.

Water Level Fluctuations-Diversion Pool, Thermalito Forebay, and Thermalito Afterbay

Monitoring of the effects of Thermalito Afterbay water level fluctuations on nesting waterfowl during 2002 indicated that flooding of waterfowl nests was adversely affecting waterfowl production. In cooperation with stakeholders, DWR modified spring 2003 Afterbay water level fluctuations and evaluated associated impacts to waterfowl production. Monitoring of the 2003 experimental Afterbay water level fluctuations indicated that the operational pattern virtually eliminated waterfowl nest flooding.

Nesting Clark's and western grebe colonies also have the potential to be adversely impacted by summer Afterbay water level fluctuations. These grebes nest colonially in protected shallow water areas of the Afterbay. Nests are constructed of floating aquatic and emergent vegetation. These floating nests provide protection from terrestrial predators. Excessive draw downs can strand nests on exposed mudflats leading to increased risk of predation or abandonment. Stranding of a limited number of nests was reported during 2003 at one of the Afterbay grebe nesting colonies (Ivey 2003). However, no abandonment or predation losses were identified and Thermalito grebe production/pair was the second highest level (1.41 young/brood) recorded in the 2003 statewide survey.

Gravel Harvest

Gravel harvest currently occurs within the portion of the Oroville Wildlife Area (OWA) which straddles the Feather River. This area was mined for gold during the early 1900s. As a result, significant dredging and hydraulic mining left the area with many medium to large ponds (dredger ponds) and mounds of gravel/cobble. Barren gravel/cobble piles currently exist on approximately 615 acres within the OWA. The free draining nature of these dredger tailings and distance to groundwater precludes the establishment of vegetation except in areas at elevations near the water table. These largely barren areas have been subject to gravel harvest during project construction and are a continuing source of gravel for project maintenance. Further, large-scale, commercial gravel harvest activities currently occur within portions of the OWA through a mining lease under the jurisdiction of DWR

Potential wildlife impacts associated with gravel extraction and transportation include noise, dust, disturbance, direct mortality, and habitat modification/loss. However, from a

wildlife habitat perspective, carefully designed and implemented gravel harvest within the OWA may well be the only effective large-scale, long-term habitat improvement tool available to land managers. Large areas of exposed dredger tailings provide habitat for few wildlife species and can act as a barrier to dispersal and movement of some species. Gravel extraction serves to remove larger material while retaining fine materials (sand and silt) necessary for vegetative establishment. Gravel harvest can also effectively decrease the distance to groundwater to levels suitable for vegetative establishment and maintenance. Carefully managed gravel harvest can in the long-term replace the existing 615 acres of relatively barren dredger tailings within the OWA with riparian, freshwater emergent wetland, and lacustrine habitat of higher wildlife value. Further, gravel replenishment within the Feather River floodplain using existing sources within the OWA has the potential to improve fisheries habitat including recovery of State and federally "listed" salmon and steelhead while improving wildlife habitat.

DWR in cooperation with the California Department of Conservation (DOC), DFG, U. S. Fish and Wildlife Service (USF&WS) and the commercial and local mining interest will continue to evaluate opportunities to minimize impacts to wildlife and wildlife habitat while maximizing potential benefits associated with gravel harvest within the OWA.

Project Related Maintenance Activities

Most ongoing maintenance practices have minimal impacts to wildlife populations or wildlife habitats. However, opportunities for modification of certain maintenance practices to minimize or avoid impacts to State or federally listed species have been identified. These maintenance activities include:

- road, fuel break, drainage system, and fence maintenance practices to minimize impacts to vernal pool invertebrates or valley elderberry longhorn beetle (VELB)
- current Butte County Mosquito Abatement practices in areas containing vernal pool habitats or VELB habitat
- rodent control practices within giant garter snake habitat
- herbicide use within or adjacent to vernal pool habitats, giant garter snake habitats or VELB habitats
- bridge maintenance effects on nesting peregrine falcons
- seasonal limits on trail maintenance activities within bald eagle nest territories
- vegetative control within transmission line corridor effects on VELB

Opportunities to modify maintenance practices to minimize and avoid potential impacts to State and federal ESA species habitats will be explored during ESA consultations with respective regulatory agencies. Modification of some, or all, of these potential maintenance practices is likely to be included in the Relicensing Biological Assessment.

Evaluation of Direct and Indirect Habitat Losses

For the purposes of these analyses, habitat losses related to inundation are considered type conversions rather direct or indirect habitat losses. However, it is important to realize that this type conversion represents the greatest amount of project related wildlife habitat alteration, exceeding 20,000 acres.

Project features with primarily low levels of indirect wildlife habitat loss occupy about 4,100 acres or 10 percent of the project area. Project features resulting in moderate levels of both direct and indirect habitat total about 900 acres or about two percent of the project area. While project features resulting in direct loss of wildlife habitat currently occupy about 1,200 acres or about three percent of the project area.

Additional direct and indirect habitat losses may occur resulting from implementation of Relicensing Resource Actions. To the extent possible additional habitat loss or degradation should be avoided particularly in the portion of the project area managed as a State Wildlife Area. Relicensing stakeholders should be aware of the trade-offs associated with additional road or recreational developments and long-term maintenance of wildlife habitat.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

1.1 BACKGROUND INFORMATION

Current and future DWR management and operation of the Oroville facilities may impact wildlife and their habitats. Project operation and management can affect wildlife species and their habitats in a positive or negative manner. Identification and quantification of these impacts can provide project managers and stakeholders with the information necessary to make sound management decisions. These data can be used to:

- identify management options or project modifications which minimize or avoid project-related impacts;
- identify opportunities for habitat enhancement; and,
- identify species trade-offs associated with management and operation of the facilities.

Study plan T1 calls for consolidation of the results of the other wildlife related study plans into the final report (SP-T2 through SP-T11). However, per an EWG Study Plan Change approved at the January EWG meeting, this draft final report will focus on the results of evaluations related specifically to changes in wildlife occurrences and wildlife habitat due to project operations and maintenance activities. Consolidation and summary of other terrestrial resource study plan results will be included in the Relicensing Wildlife Management Plan, a task under SP-T6.

Specific operations or maintenance activities covered under this report include water level fluctuations, Feather River flow fluctuations, gravel harvest, and maintenance practices implemented by the land management agencies within the project area. The principal land management agencies conducting project-related maintenance activities within the project area include DWR, DFG, and the California Department of Parks and Recreation (DPR).

1.1.1 Statutory/Regulatory Requirements

In addition to meeting Federal Energy Regulatory Commission guidelines, the information provided in this report is required for compliance with State and federal environmental regulations including:

- California Environmental Quality Act (CEQA)
- National Environmental Policy Act (NEPA)
- California Endangered Species Act (CESA)
- Federal Endangered Species Act (FESA)
- Federal Power Act (FPA)
- Federal Migratory Bird Treaty Act (MBTA)

1.1.2 Study Area

The study area is generally within or adjacent to the FERC project boundary, and also includes the Feather River downstream to the confluence with the Sacramento River.

The specific study area encompasses those described for SP-T3/5 through SP-T11. For analysis of special status species, the specific study area is defined in SP-T2.

1.2 DESCRIPTION OF FACILITIES

The Oroville Facilities were developed as part of the State Water Project (SWP), a water storage and delivery system of reservoirs, aqueducts, power plants, and pumping plants. The main purpose of the SWP is to store and distribute water to supplement the needs of urban and agricultural water users in northern California, the San Francisco Bay area, the San Joaquin Valley, and southern California. The Oroville Facilities are also operated for flood management, power generation, to improve water quality in the Delta, provide recreation, and enhance fish and wildlife.

FERC Project No. 2100 encompasses 41,100 acres and includes Oroville Dam and Reservoir, three power plants (Hyatt Pumping-Generating Plant, Thermalito Diversion Dam Power Plant, and Thermalito Pumping-Generating Plant), Thermalito Diversion Dam, the Feather River Fish Hatchery and Fish Barrier Dam, Thermalito Power Canal, Oroville Wildlife Area (OWA), Thermalito Forebay and Forebay Dam, Thermalito Afterbay and Afterbay Dam, and transmission lines, as well as a number of recreational facilities. An overview of these facilities is provided on Figure 1.2-1. The Oroville Dam, along with two small saddle dams, impounds Lake Oroville, a 3.5-million-acre-feet (maf) capacity storage reservoir with a surface area of 15,810 acres at its normal maximum operating level.

The hydroelectric facilities have a combined licensed generating capacity of approximately 762 megawatts (MW). The Hyatt Pumping-Generating Plant is the largest of the three power plants with a capacity of 645 MW. Water from the six-unit underground power plant (three conventional generating and three pumping-generating units) is discharged through two tunnels into the Feather River just downstream of Oroville Dam. The plant has a generating and pumping flow capacity of 16,950 cfs and 5,610 cfs, respectively. Other generation facilities include the 3-MW Thermalito Diversion Dam Power Plant and the 114-MW Thermalito Pumping-Generating Plant.

Thermalito Diversion Dam, four miles downstream of the Oroville Dam creates a tail water pool for the Hyatt Pumping-Generating Plant and is used to divert water to the Thermalito Power Canal. The Thermalito Diversion Dam Power Plant is a 3-MW power plant located on the left abutment of the Diversion Dam. The power plant releases a maximum of 615 cubic feet per second (cfs) of water into the river.

The Power Canal is a 10,000-foot-long channel designed to convey generating flows of 16,900 cfs to the Thermalito Forebay and pump-back flows to the Hyatt Pumping-Generating Plant. The Thermalito Forebay is an off-stream regulating reservoir for the 114-MW Thermalito Pumping-Generating Plant. The Thermalito Pumping-Generating Plant is designed to operate in tandem with the Hyatt Pumping-Generating Plant and

has generating and pump-back flow capacities of 17,400 cfs and 9,120 cfs, respectively. When in generating mode, the Thermalito Pumping-Generating Plant discharges into the Thermalito Afterbay, which is contained by a 42,000-foot-long earth-fill dam. The Afterbay is used to release water into the Feather River downstream of the Oroville Facilities, helps regulate the power system, provides storage for pump-back operations, and provides recreational opportunities. Several local irrigation districts receive water from the Afterbay.

The Feather River Fish Barrier Dam is downstream of the Thermalito Diversion Dam and immediately upstream of the Feather River Fish Hatchery. The flow over the dam maintains fish habitat in the low-flow channel of the Feather River between the dam and the Afterbay outlet, and provides attraction flow for the hatchery. The hatchery was intended to compensate for spawning grounds lost to returning salmon and steelhead trout from the construction of Oroville Dam. The hatchery can accommodate 15,000 to 20,000 adult fish annually.

The Oroville Facilities support a wide variety of recreational opportunities. They include: boating (several types), fishing (several types), fully developed and primitive camping (including boat-in and floating sites), picnicking, swimming, horseback riding, hiking, off-road bicycle riding, wildlife watching, hunting, and visitor information sites with cultural and informational displays about the developed facilities and the natural environment. There are major recreation facilities at Loafer Creek, Bidwell Canyon, the Spillway, North and South Thermalito Forebay, and Lime Saddle. Lake Oroville has two full-service marinas, five car-top boat launch ramps, ten floating campsites, and seven dispersed floating toilets. There are also recreation facilities at the Visitor Center and the OWA.

The OWA comprises approximately 11,000-acres west of Oroville that is managed for wildlife habitat and recreational activities. It includes the Thermalito Afterbay and surrounding lands (approximately 6,000 acres) along with 5,000 acres adjoining the Feather River. The 5,000 acre area straddles 12 miles of the Feather River, which includes willow and cottonwood lined ponds, islands, and channels. Recreation areas include dispersed recreation (hunting, fishing, and bird watching), plus recreation at developed sites, including Monument Hill day use area, model airplane grounds, three boat launches on the Afterbay and two on the river, and two primitive camping areas. California Department of Fish and Game's (DFG) habitat enhancement program includes a wood duck nest-box program and dry land farming for nesting cover and improved wildlife forage. Limited gravel extraction also occurs in a number of locations.

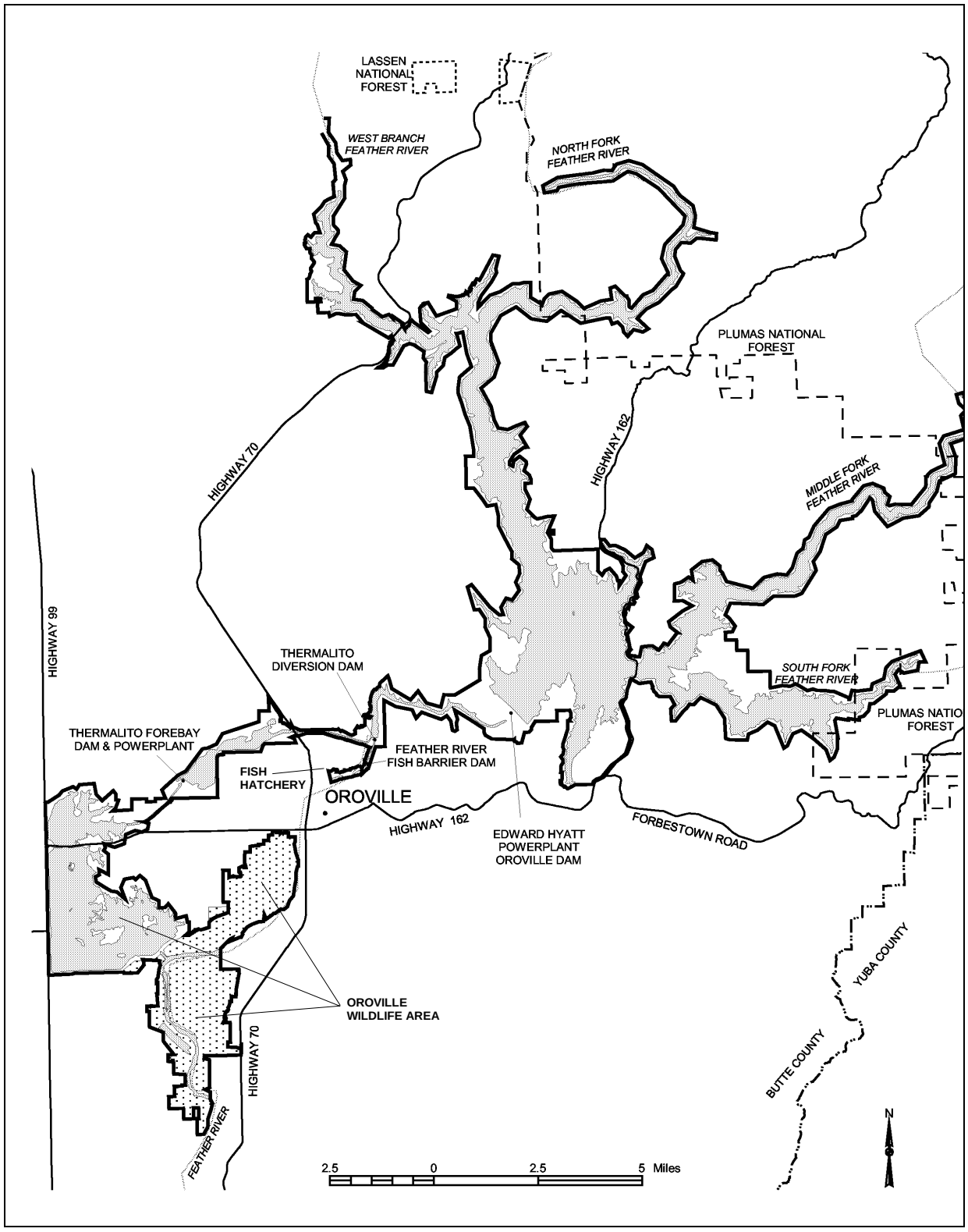


Figure 1.2-1. Oroville Facilities FERC Project Boundary

1.3 CURRENT OPERATIONAL CONSTRAINTS

Operation of the Oroville Facilities varies seasonally, weekly and hourly, depending on hydrology and the objectives DWR is trying to meet. Typically, releases to the Feather River are managed to conserve water while meeting a variety of water delivery requirements, including flow, temperature, fisheries, recreation, diversion and water quality. Lake Oroville stores winter and spring runoff for release to the Feather River as necessary for project purposes. Meeting the water supply objectives of the SWP has always been the primary consideration for determining Oroville Facilities operation (within the regulatory constraints specified for flood control, in-stream fisheries, and downstream uses). Power production is scheduled within the boundaries specified by the water operations criteria noted above. Annual operations planning is conducted for multi-year carry over. The current methodology is to retain half of the Lake Oroville storage above a specific level for subsequent years. Currently, that level has been established at 1,000,000 acre-feet (af); however, this does not limit draw down of the reservoir below that level. If hydrology is drier than expected or requirements greater than expected, additional water would be released from Lake Oroville. The operations plan is updated regularly to reflect changes in hydrology and downstream operations. Typically, Lake Oroville is filled to its maximum annual level of up to 900 feet above mean sea level (msl) in June and then can be lowered as necessary to meet downstream requirements, to its minimum level in December or January. During drier years, the lake may be drawn down more and may not fill to the desired levels the following spring. Project operations are directly constrained by downstream operational constraints and flood management criteria as described below.

1.3.1 Downstream Operation

An August 1983 agreement between DWR and DFG entitled, “Agreement Concerning the Operation of the Oroville Division of the State Water Project for Management of Fish & Wildlife,” sets criteria and objectives for flow and temperatures in the low flow channel and the reach of the Feather River between Thermalito Afterbay and Verona. This agreement: (1) establishes minimum flows between Thermalito Afterbay Outlet and Verona which vary by water year type; (2) requires flow changes under 2,500 cfs to be reduced by no more than 200 cfs during any 24-hour period, except for flood management, failures, etc.; (3) requires flow stability during the peak of the fall-run Chinook spawning season; and (4) sets an objective of suitable temperature conditions during the fall months for salmon and during the later spring/summer for shad and striped bass.

1.3.1.1 Instream Flow Requirements

The Oroville Facilities are operated to meet minimum flows in the Lower Feather River as established by the 1983 agreement (see above). The agreement specifies that Oroville Facilities release a minimum of 600 cfs into the Feather River from the

Thermalito Diversion Dam for fisheries purposes. This is the total volume of flows from the diversion dam outlet, diversion dam power plant, and the Feather River Fish Hatchery pipeline.

Generally, the instream flow requirements below Thermalito Afterbay are 1,700 cfs from October through March, and 1,000 cfs from April through September. However, if runoff for the previous April through July period is less than 1,942,000 af (i.e., the 1911-1960 mean unimpaired runoff near Oroville), the minimum flow can be reduced to 1,200 cfs from October to February, and 1,000 cfs for March. A maximum flow of 2,500 cfs is maintained from October 15 through November 30 to prevent spawning in overbank areas that might become de-watered.

1.3.1.2 Temperature Requirements

The Diversion Pool provides the water supply for the Feather River Fish Hatchery. The hatchery objectives are 52°F for September, 51°F for October and November, 55°F for December through March, 51°F for April through May 15, 55°F for last half of May, 56°F for June 1-15, 60°F for June 16 through August 15, and 58°F for August 16-31. A temperature range of plus or minus 4°F is allowed for objectives, April through November.

There are several temperature objectives for the Feather River downstream of the Afterbay Outlet. During the fall months, after September 15, the temperatures must be suitable for fall-run Chinook. From May through August, they must be suitable for shad, striped bass, and other warmwater fish.

The National Marine Fisheries Service has also established an explicit criterion for steelhead trout and spring-run Chinook salmon. Memorialized in a biological opinion on the effects of the Central Valley Project and SWP on Central Valley spring-run Chinook and steelhead as a reasonable and prudent measure; DWR is required to control water temperature at Feather River mile 61.6 (Robinson's Riffle in the low-flow channel) from June 1 through September 30. This measure requires water temperatures less than or equal to 65°F on a daily average. The requirement is not intended to preclude pump-back operations at the Oroville Facilities needed to assist the State of California with supplying energy during periods when the California ISO anticipates a Stage 2 or higher alert.

The hatchery and river water temperature objectives sometimes conflict with temperatures desired by agricultural diverters. Under existing agreements, DWR provides water for the Feather River Service Area (FRSA) contractors. The contractors claim a need for warmer water during spring and summer for rice germination and growth (i.e., 65°F from approximately April through mid May, and 59°F during the remainder of the growing season). There is no obligation for DWR to meet the rice

water temperature goals. However, to the extent practical, DWR does use its operational flexibility to accommodate the FRSA contractor's temperature goals.

1.3.1.3 Water Diversions

Monthly irrigation diversions of up to 190,000 (July 2002) af are made from the Thermalito Complex during the May through August irrigation season. Total annual entitlement of the Butte and Sutter County agricultural users is approximately 1 maf. After meeting these local demands, flows into the lower Feather River continue into the Sacramento River and into the Sacramento-San Joaquin Delta. In the northwestern portion of the Delta, water is pumped into the North Bay Aqueduct. In the south Delta, water is diverted into Clifton Court Forebay where the water is stored until it is pumped into the California Aqueduct.

1.3.1.4 Water Quality

Flows through the Delta are maintained to meet Bay-Delta water quality standards arising from DWR's water rights permits. These standards are designed to meet several water quality objectives such as salinity, Delta outflow, river flows, and export limits. The purpose of these objectives is to attain the highest water quality, which is reasonable, considering all demands being made on the Bay-Delta waters. In particular, they protect a wide range of fish and wildlife including Chinook salmon, Delta smelt, striped bass, and the habitat of estuarine-dependent species.

1.3.2 Flood Management

The Oroville Facilities are an integral component of the flood management system for the Sacramento Valley. During the wintertime, the Oroville Facilities are operated under flood control requirements specified by the U.S. Army Corps of Engineers (USACE). Under these requirements, Lake Oroville is operated to maintain up to 750,000 af of storage space to allow for the capture of significant inflows. Flood control releases are based on the release schedule in the flood control diagram or the emergency spillway release diagram prepared by the USACE, whichever requires the greater release. Decisions regarding such releases are made in consultation with the USACE.

The flood control requirements are designed for multiple use of reservoir space. During times when flood management space is not required to accomplish flood management objectives, the reservoir space can be used for storing water. From October through March, the maximum allowable storage limit (point at which specific flood release would have to be made) varies from about 2.8 to 3.2 maf to ensure adequate space in Lake Oroville to handle flood flows. The actual encroachment demarcation is based on a wetness index, computed from accumulated basin precipitation. This allows higher levels in the reservoir when the prevailing hydrology is dry while maintaining adequate flood protection. When the wetness index is high in the basin (i.e., wetness in the

watershed above Lake Oroville), the flood management space required is at its greatest amount to provide the necessary flood protection. From April through June, the maximum allowable storage limit is increased as the flooding potential decreases, which allows capture of the higher spring flows for use later in the year. During September, the maximum allowable storage decreases again to prepare for the next flood season. During flood events, actual storage may encroach into the flood reservation zone to prevent or minimize downstream flooding along the Feather River.

2.0 NEED FOR STUDY

Identification and quantification of project effects on wildlife and wildlife habitat has been identified as an issue by relicensing stakeholders including stakeholders with mandatory conditioning authority and is a FERC requirement. Evaluation of project effects related to current and future operations and maintenance on wildlife resources is also required for CEQA/NEPA compliance. Further, this study is necessary as limited data exist related to project effects on wildlife resources and no previous evaluation of overall project effects on wildlife resources has been conducted.

3.0 STUDY OBJECTIVE(S)

The primary objectives of this study are to:

- identify any on-going and potential future project-related effects on wildlife and wildlife habitat
- provide information that can be used to identify potential protection, mitigation, and enhancement measures
- identify species trade-offs associated with management and operation of project facilities.

3.1 APPLICATION OF STUDY INFORMATION

The information provided in this report can be utilized in a variety of ways including:

- impact assessment and avoidance
- development of protection, mitigation and enhancement (PM&E) measures
- input to other relicensing study plans
- project operations scheduling and planning

3.1.2 Environmental Documentation

In addition to meeting FERC guidelines, the information provided in this report is required for compliance with State and federal environmental regulations including:

- California Environmental Quality Act
- National Environmental Policy Act
- California Endangered Species Act
- Federal Endangered Species Act
- Federal Power Act
- Federal Migratory Bird Treaty Act

3.1.3 Settlement Agreement

DWR or stakeholders may utilize the information in this report to identify potential PM&E measures appropriate for Settlement Agreement.

4.0 METHODOLOGY

4.1 STUDY DESIGN

A variety of study methods and analyses were employed based on the type of operational or maintenance activity evaluated.

4.1.1 Water Level Fluctuations

Evaluation of the effects of reservoir water level fluctuations focused primarily on Lake Oroville and the Thermalito Afterbay where seasonal or more frequent water level fluctuations are most likely to impact wildlife species. Further, data collection and analyses focused on wildlife species or groups of species most at risk from identified changes in water levels. These species included species or groups of species where critical life stages are most dependent on stable water elevations during certain times in the year. Generally, these species included those which nest on the water surface (grebes), piscivorous birds, and species utilizing habitats within the drawdown or inundation zones, including nesting waterfowl. These evaluations included several State or federally listed species potentially subject to the effects of water level fluctuations including bald eagle and giant garter snake.

4.1.2 Feather River Flow Fluctuations

Evaluation of operational impacts focused primarily on wildlife species and habitats directly affected by changes in seasonal project releases to the Feather River including species dependent upon riparian or riverine habitat.

4.1.3 Gravel Harvest

Both commercial gravel harvest and more limited gravel harvest by project land management agencies for maintenance activities occur within the project area. Both activities have the potential to modify existing wildlife habitats. Evaluation of gravel harvest impacts on wildlife species and habitat includes both existing gravel removal areas as well as those areas where gravel harvest is likely to occur in the future.

4.1.4 Project Maintenance Activities

Evaluation of potential wildlife related impacts associated with project area maintenance activities included area-wide, multi-agency activities. This evaluation focused primarily on maintenance activities associated with roads, trails, parking lots, boat ramps, bridges, levees, diversion structures, transmission line corridor and associated facilities and activities.

4.1.5 Evaluation of Direct and Indirect Habitat Losses

This task involved GIS data analyses to account for direct (permanent loss of wildlife habitat) and indirect habitat losses within the project area.

4.2 HOW AND WHERE THE STUDIES WERE CONDUCTED

4.2.1 Water level Fluctuations

Several different methodologies were employed to evaluate potential impacts related to water level fluctuations including:

- waterfowl and grebe nest surveys
- quarterly wildlife surveys within the drawdown/inundation zones of Lake Oroville and the Thermalito Afterbay to determine species presence, qualitative abundance, and impacts during critical life stages
- qualitative evaluation of wildlife habitats in areas subject to water level fluctuations
- California Wildlife Habitat Relationship modeling

Individual data collection and analytical methods are summarized below.

4.2.1.1 Nesting Waterfowl and Grebe Surveys

4.2.1.1.1 2002 Waterfowl Nest Surveys: To assess the impact of potential inundation on nesting waterfowl, data were collected and compared from upland and wetland habitats around the Afterbay. Eight 3.2-acre circular plots were established in areas subject to periodic inundation through project operations during late April 2002. These plots were placed adjacent to the Thermalito Afterbay in areas influenced by inundation or high ground water levels and supporting wetland vegetation including *Juncus, Scirpus, Salix, Typha,* and *Verbena*. An additional eight 3.2-acre circular plots were established in upland habitat adjacent to these wetland habitats.

Nest locations were detected by dragging a 1-inch diameter cotton rope around a central point. The movement of the rope through the vegetation flushes nesting hens from the nest allowing the surveyors to identify and map nest locations. This method does not allow assessment of predated nests where the hen is no longer present. Once flushed, nesting hens will return to the nest after the survey is completed. In each sampled plot the number of nests and number of eggs per nest was recorded.

To check the ability of this method to detect nesting waterfowl, intensive nest searches were conducted at four of the sixteen sampling locations. These searches involved two observers walking the entire plot on a 10-yard grid pattern to visually detect any missed nests or flush any nesting hens. Detailed vegetation sampling was not conducted as a part of this evaluation; however dominant species and ocular estimates of plant cover were noted during the surveys.

4.2.1.1.2 2003 Waterfowl Nest Surveys: 2003 waterfowl nest surveys were conducted in coordination with the California Waterfowl Association (CWA) and focused on sampling of DFG nest cover habitat improvement plots, unmanipulated upland habitats, and within the 900 acre wetland margin of the Thermalito Afterbay and were

implemented to test a spring 2003 water level operational scenario designed to minimize project operational impacts on nesting waterfowl. Sampling methods varied from those utilized in 2002 to conform to those utilized by CWA during long-term studies at the Afterbay. 2003 sampling consisted of dragging a rope between two surveyors to flush nesting hens in DFG nest cover enhancements, and unmanipulated upland habitats. Periodic resampling of these habitats occurred throughout the primary waterfowl nesting season in an effort to more fully quantify production, losses, and project related impacts. Area sampled was determined from either GIS analyses or from GPS boundary coordinates. Data collection at each nest located included waterfowl species, number of eggs, and relative stage of nest or egg development, GPS location, signs of predation or abandonment. Sampling of waterfowl production or losses within the 900 acre wetland margin which remained largely flooded under this operational scenario test were primarily evaluated through shoreline survey for floating eggs.

4.2.1.1.3 Nesting Grebe Surveys This evaluation was funded and directed by DFG as part of a Statewide Clark's and western grebe nesting survey. Methods employed within this study included counts of the number of nests in each colony through direct observation and enumeration, observation of colonies to determine threats to habitat and productivity, and boat-based grebe brood surveys to determine annual production and timing. The brood surveys were visual surveys which included enumeration of the number of adults of each species and associated number of juveniles over the entire surface of the Afterbay.

4.2.1.2 Lake Oroville Quarterly Drawdown/Inundation Zone Wildlife Surveys

Quarterly wildlife occurrence surveys of the Lake Oroville drawdown zone were conducted during both 2002 and 2003. Sampling occurred in February, May, July, and October in both years and was primarily boat based. These surveys were generally conducted in concert with other relicensing wildlife surveys including bald eagle and peregrine falcon nest surveys, and federal lands habitat evaluations. Data collection included a qualitative evaluation of wildlife habitat and tabulation of wildlife species utilizing the reservoir drawdown/inundation zone. Desktop data analyses were used to evaluate potential impacts to wildlife species documented to occur within the study area and identify potential for habitat improvement.

4.2.1.3 Mapping of Wildlife Habitats in Areas Subject to Water Level Fluctuations

Wildlife habitat mapping of reservoir drawdown zones was conducted as part of relicensing study SP-T4. Additional data sources included preliminary data from relicensing study SP-T3/5 which provided more detailed information on the locations and plant species occurrence within the reservoir drawdown zone. Historic and projected future operational data including modeling associated with the Bureau of Reclamation's Operating Criteria and Plans (OCAP) were used to identify the range of

likely water surface elevation fluctuations. Detailed methodologies associated with these relicensing studies can be found in respective interim and final reports.

4.2.1.4 CWHR Modeling

The California Wildlife Habitat Relationship Database was used to model certain wildlife habitats of interest including barren, lacustrine, and freshwater emergent wetlands. Model outputs include species lists of seasonal wildlife species occurrence and predictions of habitat suitability

The CWHR system is a state-of-the-art informational database that describes the management status, distribution, life history and habitat requirements of 675 of California's vertebrate wildlife species (Airola 1988). CWHR also provides predictive models that serve as a tool to analyze wildlife species responses to habitat alterations. CWHR represents the most extensive compilation of wildlife habitat information in California. The information in CWHR is a compilation of published and unpublished data as well as professional judgment by species experts.

CWHR is operated and maintained by the DFG in cooperation with the California Interagency Wildlife Task Group (CIWTG). CIWTG is comprised of representatives from the major State and federal natural resource management agencies and has worked cooperatively with DFG for over 17 years to refine and further develop CWHR.

All CWHR analyses conducted as part of this evaluation are single condition summary reports designed to be as inclusive as possible. CWHR modeling input criteria included;

- Location: Butte County
- Habitat Type: lacustrine, barren, and freshwater emergent wetland
- Seral Stage: all available seral stages (whether currently present or not)
- Habitat Elements: assumed presence of all habitat elements
- Species: all potential species
- Seasonality: all possible seasonal occurrences

4.2.2 Feather River Flow Fluctuations

Analyses of the effects of Feather River flow fluctuations on wildlife was generally conducted as a desktop analyses utilizing three existing sources of data including:

- pre and post-project historical flow records
- OCAP flow projections through 2020
- current (baseline) operational project releases

Additional data collection efforts were focused on potential impacts to nesting bank swallow, a State listed Threatened species. A primarily boat-based survey of the Feather River between Oroville Dam and Verona was completed during June 2002 and again during June 2003. All active and inactive colonies were mapped and the total

number of burrows in each colony was tabulated. Further, the distance from the waterline to the lowest active burrow in each colony was estimated during 2003. These data were used to model potential flow related impacts within the breeding season. Modeling included development of stage/discharge relationships at each colony location. All colony locations detected were mapped using GPS technology. Only burrows at least 6 inches in depth with dark entrances as viewed from distances of 10 to 30 yards were included in the census.

4.2.3 Gravel Harvest

Analyses of the effects of gravel harvest on wildlife species and habitats were completed using several data sources including:

- CWHR habitat mapping conducted as part of relicensing study SP-T4
- Qualitative evaluation of the habitat effects of current and historic gravel removal/harvest activities
- Evaluation of current gravel mining reclamation plans and lease conditions

CWHR mapping was used to identify locations of past, current, and likely future gravel harvest within the portion of the OWA adjacent to the Feather River. Qualitative habitat evaluations were used to access post harvest habitat conditions and to evaluate potential gravel harvest protection, mitigation, or enhancement measures. Evaluation of current gravel mining reclamation plans and existing leases was used to develop projections of post-mining habitat conditions within these localized areas and to develop potential protection, mitigation, or enhancement measures

4.2.4 Project Maintenance Activities

Identification of maintenance activities with the potential to impact wildlife species or habitats was primarily based on interviews with DFG, DPR, and DWR maintenance staffs. These interviews yielded information on the location, type, frequency, duration, and specific method of maintenance activity. Additional data sources included GIS mapping of all project facilities including roads, trails, parking lots, boat ramps, diversion, impoundments, conveyance structures, levees, fuel breaks, transmission line corridors, storage areas, and other project associated features. These GIS data were also utilized to identify project related areas of disturbed, barren, or otherwise significantly degraded areas suitable for restoration. These data were used in desktop analyses to predict potential wildlife impacts associated with project related maintenance activities.

4.2.5 Evaluation of Direct and Indirect Habitat Losses

All project facilities were mapped in GIS format. Each general type of facility was categorized into either a direct or indirect habitat loss class. Area occupied by each

group of facilities and category of habitat loss were calculated. Data analyses included identification guidelines to minimize future direct and indirect wildlife habitat losses. A description of the facilities categorization breakdown used in these analyses is presented in 4.2.5.1 below.

4.2.5.1 FERC Project Area Facilities

Cemetery
Typical cemeteries – Thompson Flat/Pioneer cemetery. Mature vegetation, some disturbance.

Facilities
Includes facilities consisting primarily of concrete and steel structures with no vegetation (including landscaping). Category includes some dams, fish hatchery, equipment storage areas, power canal, spillway, unvegetated sewer ponds, tanks, and parking lots that go with them.

Habitat Improvement
Habitat Improvement areas include brood ponds, nest cover, and forage enhancement areas.

Miscellaneous Disturbed
Miscellaneous disturbed usually included graded areas beside roads or other facilities, often embankments. These areas may have some rather degraded herbaceous/weedy vegetation on parts.

Recreation Boating Facilities
Boating facilities include unvegetated boat ramps, marinas, cartop boat launch sites, and their associated parking lots.

Recreation Campgrounds
Campgrounds include the vegetated campsites, excluding the roads that go thru them, which are separately mapped, as “Roads”. This facility type also includes the parking lots associated with campgrounds. Also includes boat-in and rather primitive campgrounds.

Recreation Day Use
Includes all designated Day Use Area lands that are not also roads. Category does include the Day Use area parking lots. Also included are miscellaneous recreation sites such as picnic areas, shooting areas, the Foreman Creek road networked area, a Swim Beach, Model Airplane Club, and a Group Staging Area. Moderately high disturbance and some natural vegetation, some landscaping.

Recreation Facilities

Moderate amount of disturbance with some landscaping. Has structures such as entrance area to Loafer Ck Recreation Area, the Bidwell Canyon Visitor's Center, Campfire circle and some parking lots associated with some of the above.

Recreation Trails

All trails not also mapped in the middle of (and therefore attributed as) Roads. Trails data were primarily developed from GPS data, but a few were attributed after the fact from air photo interpretation. Category includes trail substrate (dirt, wooden, gravel, and paved surfaces, as well as unknown surfaces).

Recreation General

All raw land, with natural vegetation, but probably minor disturbance, within designated Recreation Areas but not otherwise mapped as roads, facilities, trails etc.

Roads

Includes all roads, including those that also coincide with trails or levees. GIS data developed from both GPS and air photo interpretation. Category includes paved, gravel and dirt surfaces, and many unknown surfaces. All have acreages since they are polygons (so no need to assign widths to certain types etc.).

Transmission Lines

These are strips of raw land, with natural vegetation, sometimes probably partially cleared, underlying mapped transmission line corridors, that are not otherwise mapped as other features.

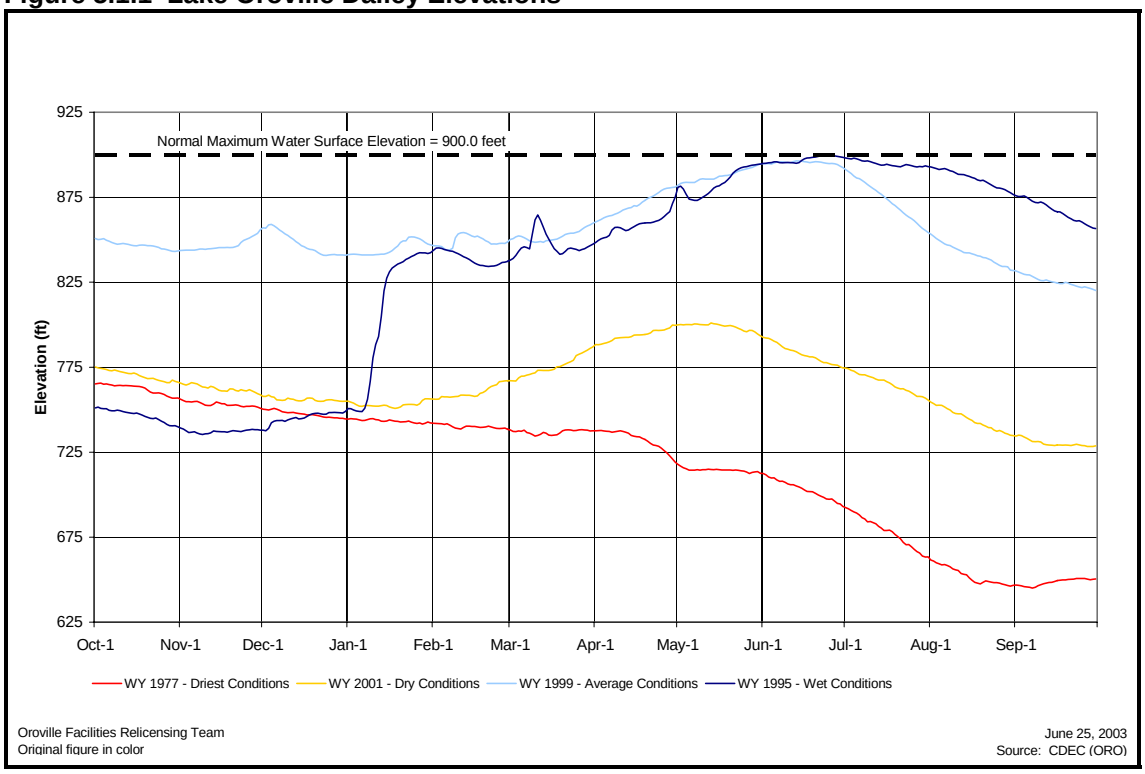
5.0 STUDY RESULTS

5.1 WATER LEVEL FLUCTUATIONS-LAKE OROVILLE

Lake Oroville stores winter and spring runoff that is released into the Feather River, as necessary, for project purposes. The reservoir has a storage capacity of 3,538,000 acre-feet (af) and is fed by the North, Middle, and South Forks of the Feather River. Average annual unimpaired runoff into the reservoir is about 4.2 million acre-feet (maf). The water surface elevation and water surface area at maximum operating storage are 900 feet above mean sea level (msl) and 15,810 acres, respectively. The shoreline covers 167 miles at maximum operating storage.

Historic Lake Oroville water surface elevations have ranged from a high of 900 feet above mean sea level to a low of about 640 feet above mean sea level (Figure 5.1.1)

Figure 5.1.1 Lake Oroville Dailey Elevations



OCAP 2020 projections indicate that annual Lake Oroville water level fluctuations are likely to increase as environmental, local, and export water supply needs increase over time.

The annual water level fluctuations within the drawdown zone of Lake Oroville result from various natural precipitation/runoff events and project operations for water supply, hydropower generation, and flood control. This annual cycle generally involves increasing lake levels from November through May or June in most years followed by

rapidly decreasing water levels until the initiation of fall precipitation and runoff. These water level fluctuations create a harsh environment for establishment of plant cover within the drawdown zone. Loss of soil to wave action, periodic inundation; followed by severe desiccation have resulted in a generally barren drawdown zone. Past attempts to revegetate portions of the drawdown zone have generally been unsuccessful without first year summer irrigation. DWR experimented with establishment of woody cover species within the drawdown zone during the 1980s for warmwater fisheries enhancement. Many of the willows (*Salix sp.)* and buttonbush *(Cephalanthus occidentalis)* planted in these experimental plots have survived for over 14 years (Jerry Boles, DWR personnel. comm.). A multi-agency/stakeholder group experimented with spring hydroseeding of suitable areas within the drawdown zone to establish herbaceous cover species for aesthetics, wildlife habitat, and warmwater fisheries improvement during the early 1980s. These efforts were unsuccessful. However, subsequent analyses have indicated that hydroseeding timing and seed mix may have been less than optimal.

Lack of vegetative cover within the drawdown zone severely limits wildlife use of this area. Thirty-six wildlife species were been detected on at least one occasion during field surveys using habitats within the drawdown zone including acorn woodpecker, American white pelican, bald eagle, barn swallow, belted kingfisher, black bear, black phoebe, California ground squirrel, California gull, Canada goose, canyon wren, American crow, American dipper, black-tailed deer, common merganser, double-crested cormorant, European starling, great egret, great-blue heron, greater yellowlegs, killdeer, mallard, northern rough-winged swallow, osprey, raccoon, ring-billed gull, rock dove, snowy egret, spotted sandpiper, tree swallow, turkey vulture, western aquatic garter snake, western fence lizard, western meadowlark, and white-fronted goose. Several of these species may utilize habitats within the drawdown zone for reproduction including belted kingfisher, Canada goose, canyon wren, American dipper, killdeer, mallard, common merganser, and northern rough-winged swallow. CWHR modeling of barren habitat in Butte County indicate that this habitat type is essential for 17 species in Butte County. However, CWHR predicts that up to 82 wildlife species in Butte County may utilize barren habitats at some point in their life cycle (SP-T4 Appendix A).

Rapid winter/spring inflow into the reservoir could potentially result in direct mortality of some sedentary wildlife species or life stages within the drawdown zone of the reservoir. Rapidly rising reservoir levels and associated potential wildlife impacts are most likely to occur during years of high reservoir drawdown and within the confined canyons portions of the upper reservoir arms. Due to the physical topography of the reservoir, the lower the lake level, the more rapid the water level rises at any given inflow. The period of reproduction for many of the wildlife species using the drawdown zone overlaps with the period of reservoir infilling. Nests, eggs, or young of these species could be impacted by rapidly rising water levels just as they would be in upstream unregulated riverine habitat. However, the extent of these wildlife losses would be substantially less under these natural flow events within the reservoir drawdown zone as lower densities of far fewer species utilize the barren drawdown zone. Successful reproduction by small numbers of mallard, Canada goose, common

merganser and northern-rough-winged swallow were observed within the drawdown zone of Lake Oroville during surveys.

The barren drawdown zone generally lacks cover (a required habitat element for most wildlife species). This lack of cover primarily affects wildlife in two ways. Lack of adequate cover reduces or eliminates the areas suitability as wildlife habitat and subject wildlife species transiting from cover to water with increased risk of predation. Even large mammals can experience increased risk of predation within the drawdown zone.

As reservoir levels drop, energy expenditures increase for piscivorous birds including the osprey, bald eagle, herons, egrets, belted kingfisher, and double-crested cormorants. These species must travel greater distances to forage and contend with greater vertical and horizontal distances when returning fish to the nest. Further, species like bald eagle and osprey must increasingly forage on the wing as opposed to a perch as reservoir levels recede from the high water mark. Fairly extensive warm water fisheries habitat improvement has been conducted within the upper levels of the reservoir drawdown zone. These cover enhancements tend to concentrate fish of several size classes and are attractive foraging locations for piscivorous birds. Placement of the warmwater fisheries habitat structure at a variety of elevations within the reservoir drawdown zone in the vicinity of bald eagle and osprey nest territories could improve production and survival of nestling for these and other piscivorous bird species.

U.S. Bureau of Reclamation conducted statistical analyses of the effects of reservoir water surface elevation and bald eagle productivity on Lake Shasta. These analyses indicated a long-term positive correlation between bald eagle productivity and average water surface elevation during April through July (Reclamation 1992). While this statistical relationship is documented, the biological factors responsible for it are not currently known. Bald eagles may be affected by water surface elevation on Oroville in a similar manner. However, the paucity of eagle reproduction data and the relatively small number of nesting eagles on Oroville do not allow meaningful statistical analyses.

5.2 WATER LEVEL FLUCTUATIONS-DIVERSION POOL, THERMALITO FOREBAY, AND THERMALITO AFTERBAY

Changes in the Diversion Pool water surface elevation are minimal and normally vary within a range of 222.5 feet to 224.5 feet for a maximum water surface elevation change of two feet (excluding spill conditions). Likewise, Thermalito Forebay generally operates with minimal fluctuations in water surface elevation ranging between 221.0 and 224.5 feet. Increased variability in water surface elevation occurs in the Power Canal as the water surface elevation reflects the difference between the Forebay and Afterbay water surface elevations. Water surface elevation fluctuations of four to six feet can occur. However, the power canal is primarily (80 percent) a concrete lined channel with only minor wildlife use.

Water level fluctuations occur on a weekly basis within the Thermalito Afterbay. These elevations generally range between 127 and 135 feet above mean sea level. However, water surface elevation fluctuations between 124 and 136 feet (12 feet total fluctuation) can occur. Gentle gradient, routine inundation, and relatively minor water level fluctuations (compared to Lake Oroville) have resulted in the establishment of over 900 acres of wetland habitat along the north and east edges of the Afterbay.

In contrast to the Lake Oroville, the drawdown zone of the Afterbay supports rich wildlife assemblages and a high degree of habitat diversity. Further, operational water level fluctuations provide habitats generally absent from other project facilities with more constant water levels. Survey data indicate that exposed mudflats seasonally provide habitat for a variety of migratory shorebirds including the American pipit, black-necked stilt, black tern, California gull, Caspian tern, Forster's tern, greater yellowlegs, least sandpiper, long-billed dowitcher, ring-billed gull, semipalmated sandpiper, spotted sandpiper, and white-faced ibis.

Other wading birds and other waterfowl have been documented to utilize the mudflats as well as shallow flooded areas. These species include the American bittern, American coot, American white pelican, American widgeon, black-crowned night heron, bufflehead, Canada goose, canvasback, cattle egret, cinnamon teal, common goldeneye, common merganser, common moorhen, eared grebe, gadwall, great egret, great-blue heron, greater scaup, green heron, horned grebe, lesser scaup, mallard, northern pintail, northern shoveler, pied-billed grebe, redhead, ring-necked duck, ruddy duck, snowy egret, tundra swan, white-fronted goose, and wood duck.

Additional species observed within the wetland margin of the Afterbay include the barn swallow, black phoebe, black-shouldered kite, black-tailed jackrabbit, Brewer's blackbird, brown-headed cowbird, bullfrog, common garter snake, common yellowthroat, cottontail, gopher snake, long-billed marsh wren, northern harrier, northern rough-winged swallow, pacific chorus frog, racer, raccoon, red-winged blackbird, ring-necked pheasant, short-eared owl, striped skunk, tree swallow, Virginia opossum, violet-green swallow, and western aquatic garter snake.

The wildlife habitats created by construction and operation of the Afterbay have resulted in one of the most diverse wildlife assemblages within the project area. However, for some life stages of some species (primarily nesting/brooding waterfowl and nesting grebes) the water level fluctuations at the Afterbay can adversely impact production and survival.

DWR, DFG, CWA, and other stakeholders constructed five waterfowl brood ponds in and around the Afterbay during the last 15 years. These waterfowl brood ponds are not subject to Afterbay water level fluctuations and were constructed to improve waterfowl brooding habitat by providing a more consistent water surface elevation with adjacent vegetative cover.

These ponds are designed to be recharged directly from the Afterbay. Project operations have been modified in consultation with stakeholders during most years to accommodate recharge of the brood ponds during the waterfowl-breeding season (April 15th through July 31st) at a regular interval. Brood pond recharge is accomplished by raising the Afterbay water level to a minimum water surface elevation of 134.1 feet for a 12 hour period.

A field planning session was held between DWR operations and environmental staff, CWA, and DFG prior to the 2002 waterfowl nesting season. This field session lead to a consensus concerning spring 2002 Afterbay water level fluctuations during the waterfowl nesting and brooding seasons. The consensus basically identified the frequency and water surface elevation required to recharge and maintain the brood ponds. It was noted during the planning session that high water levels (either operational or for brood pond recharge) could flood potential waterfowl nesting habitat along the Afterbay margin during the nesting season.

Sudden or periodic increases in water levels within the Afterbay have the potential to adversely affect a wide variety of wildlife species by flooding the majority of the 900 acres of wetland habitat around the Afterbay. This flooding serves to temporarily displace wildlife. Further, this periodic flooding can result in direct mortality of some life stages of certain species. In particular, spring high water levels have occasionally been observed to flood waterfowl nests, resulting in loss of eggs. The extent or significance of these losses was unknown. In an effort to evaluate this issue, DWR staff conducted waterfowl nest surveys in various habitats around the Thermalito Afterbay during mid to late April 2002. These studies were designed to provide preliminary data, which could be used to evaluate the significance of any impacts, refine future studies, or aide in the development of potential PM&E measures.

2002 waterfowl nest survey data indicate that both upland and wetland habitats were used for nesting at rates of 0.16 nests/acre and 0.28 nests/acre, respectively. Subsequent site visits indicated that virtually all emergent wetland and transitional vegetation areas were inundated due to spring 2002 Thermalito Afterbay fluctuations during incubation and that substantial losses of waterfowl eggs occurred.

In an effort to reduce waterfowl nest/egg losses related to Thermalito Afterbay water level fluctuations, DWR evaluated (in cooperation with stakeholders) an experimental water level operation during the waterfowl nesting period in 2003. This experimental operation involved raising the water level in the in the Afterbay to a relatively high level (>134.1 feet) every 9 days during this period. At this Afterbay water level elevation the entire marginal wetland habitat is flooded. Hen mallards take approximately 10 to 12 days to construct a nest and initiate egg laying. Regular, periodic flooding would force hens to select nest sites and lay eggs above the fluctuating inundation zone.

Monitoring of the effectiveness of this 2003 experimental water level operation indicated that it virtually eliminated losses of waterfowl nests and eggs. Further, waterfowl use of upland nest cover plantings were significantly greater than in previous years with nest

densities as great as 10 nests/acre. 2003 spring Afterbay water level management also served to maintain water surface elevations within waterfowl brood ponds.

Nesting Clark's and western grebe colonies also have the potential to be adversely impacted by summer Afterbay water level fluctuations. These grebes nest colonially in protected shallow water areas of the Afterbay. Nests are constructed of floating aquatic and emergent vegetation. These floating nests provide protection from terrestrial predators. Excessive drawdowns can strand nests on exposed mudflats leading to increased risk of predation or abandonment. Stranding of a limited number of nests was reported during 2003 at one of the Afterbay grebe nesting colonies (Ivey 2003). However, no abandonment or predation losses were identified and Thermalito grebe production per pair was the second highest level (1.41 young/brood) recorded in the statewide survey during 2003.

Potentially suitable giant garter snake (a State and federally listed Threatened species) habitat is also present along portions of the Afterbay and Forebay margin. Afterbay water level fluctuations during the snake's active period (April through September) can subject this highly aquatic snake to increased risk of predation and reduce habitat suitability. Existing waterfowl brood ponds can provide a refuge for giant garter snakes during periods of Afterbay drawdown. Additional conservation measures to protect giant garter snake and their habitat are likely to be addressed during the ESA Section 7 consultation process. These conservation measures may include extending the period of brood pond recharge throughout the snake's active period beyond those dates identified for waterfowl brooding.

5.3 FEATHER RIVER FLOW FLUCTUATIONS

Project related flow releases largely control Feather River flow above the Yuba River and provide a significant percentage of the flow at the mouth under most conditions. Project operations (primarily flood control) serve to limit the amount of flow variability within the lower Feather River. Winter flows are significantly less than would occur in an uncontrolled watershed; while summer/fall flows are substantially greater. This reduced flow variability and the disruption of sediment movement by Oroville Dam and other upstream reservoirs serve to influence natural geomorphic processes including erosion, deposition, and flooding. Further, river levees reduce the floodplain, which further constrains channel meander and other natural geomorphic processes. All of these factors can serve to limit the establishment and maintenance of riparian habitat. Cottonwood-willow riparian habitat support more breeding avian species than any other comparable broad habitat type in California (Gaines 1977). Up to 250 species of amphibian, reptile, bird, or mammal may occur along the Feather River (DFG 2002). Quantification of project related impacts to riparian habitat is being conducted under Relicensing Study SP-T3/5.

Bank swallow, a State listed Threatened species, has the potential to be directly and indirectly impacted by both flood control and water supply operations on the Feather

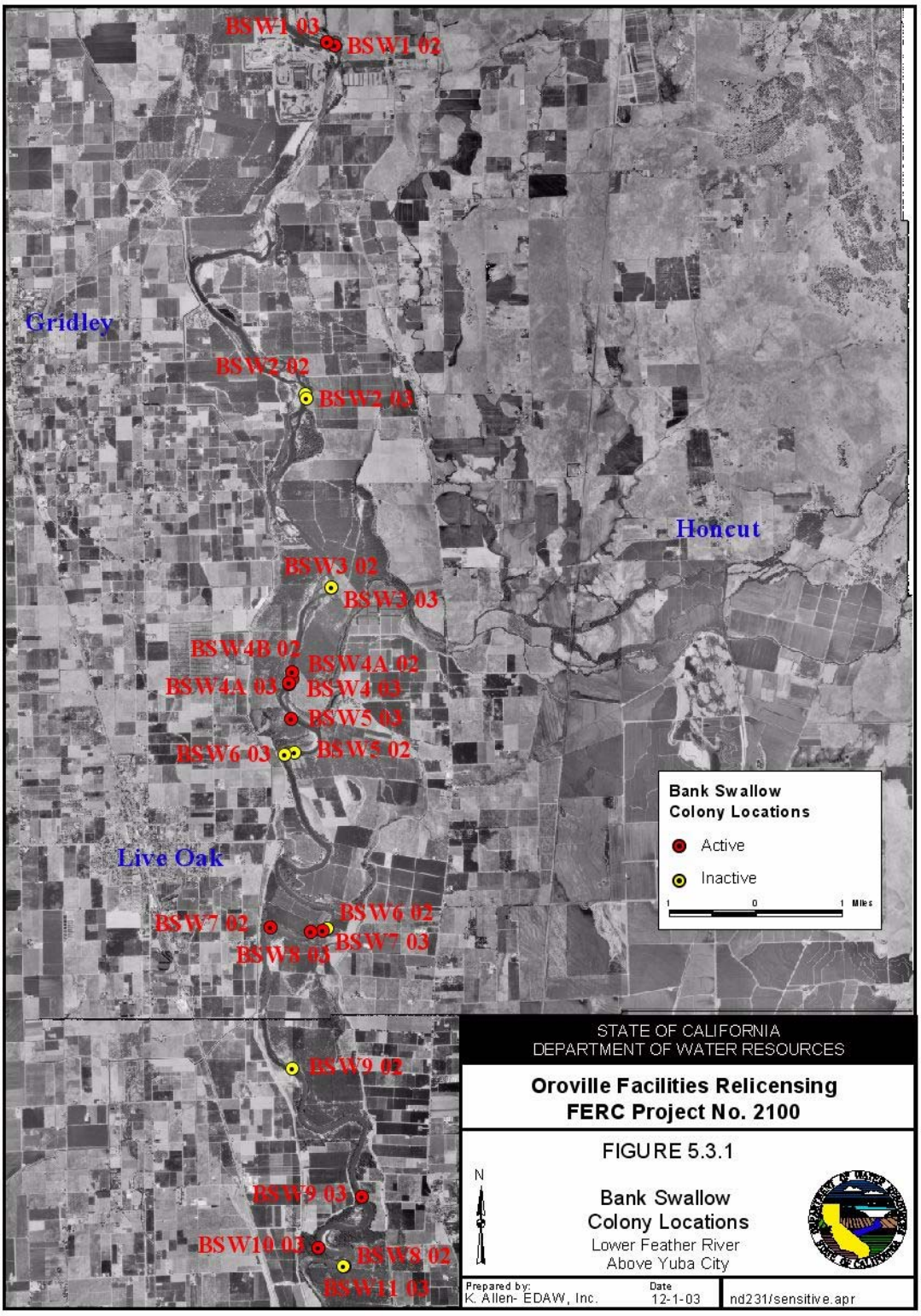
River below the project area. Bank swallows nest on eroded riverbanks and thus are probably the wildlife species most directly at risk from changes in project releases.

The 2003 bank swallow survey results documented the presence of fifteen bank swallow colonies on the Feather River between Oroville Dam and Verona totaling 3,594 burrows (Figures 5.3.1 and 5.3.2). An occupancy rate of 47 percent was applied to the number of burrows in active colonies yielding an adult population estimate of 1,689 pairs in 2003.

Bank swallows are dependent upon vertical eroded banks of a proper friable soil composition. High flows and associated bank erosion can result in both positive and negative impacts on this species. Flooding causes bank erosion and soil deposition. Erosion produces the vertical banks, while soil deposition is the source of the friable soils needed for burrow construction. Lack of high flows results in decreased slope of eroded banks and subsequent abandonment by nesting bank swallows. However, bank erosion resulting from flooding can also result in the need for managed flows, bank protection, and channelization which reduce the quantity and quality of bank swallow habitat.

Bank erosion does occur at certain locations on the Feather River at flows as low as 10,000 cfs. However, major flows in the 20,000 to 30,000 cfs range are generally required to create and maintain significant amounts of bank swallow nesting habitat. Data analyses indicate that flows > 20,000 cfs have occurred post-project on the average at 2.3 year return intervals (Gridley Gage data). Further, data analyses indicate that flows greater than 20,000 cfs occurred pre-project at a reoccurrence interval of 0.09 years (Oroville gage data). Project related flood control activities have substantially altered the reoccurrence interval of flows in the 20,000 cfs range. Further, the reoccurrence interval of major flows (> 50,000 cfs) have also been substantially reduced from a 1.9 year return interval pre-project (Oroville gage data) to a 3.1 year return interval post-project (Gridley gage data). These channel forming events can create extensive amounts of high quality bank swallow habitat for a period of time.

Streamflow is not the only factor controlling bank erosion rates. Bank saturation, length of the period of high flow, bank vegetative cover, channel geometry, soil composition, geologic structure, and bank protection measures can also influence erosion rates. Bank protection measures are currently in place along 11.2 percent of the Feather River channel below the Thermalito Outfall (preliminary data SP-G2). In general, these bank protection measures prevent bank erosion at flows up to bank full events. Both bank protection measures and project related flood control activities serve to limit/restrict the quantity and quality of bank swallow habitat created and maintained.


BSW1 03
BSW1 02
Gridley
BSW2 02
BSW2 03
Honcut
BSW3 02
BSW3 03
BSW4B 02
BSW4A 02
BSW4A 03
BSW4 03
BSW5 03
BSW6 03
BSW5 02
Bank Swallow
Colony Locations
Active
Inactive
1 0 1 Miles
Live Oak
BSW7 02
BSW6 02
BSW7 03
BSW8 03
BSW9 02
BSW9 03
BSW10 03
BSW8 02
BSW11 03
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities Relicensing
FERC Project No. 2100
FIGURE 5.3.1
N
Bank Swallow
Colony Locations
Lower Feather River
Above Yuba City
Prepared by:
K. Allen- EDAW, Inc.
Date
12-1-03
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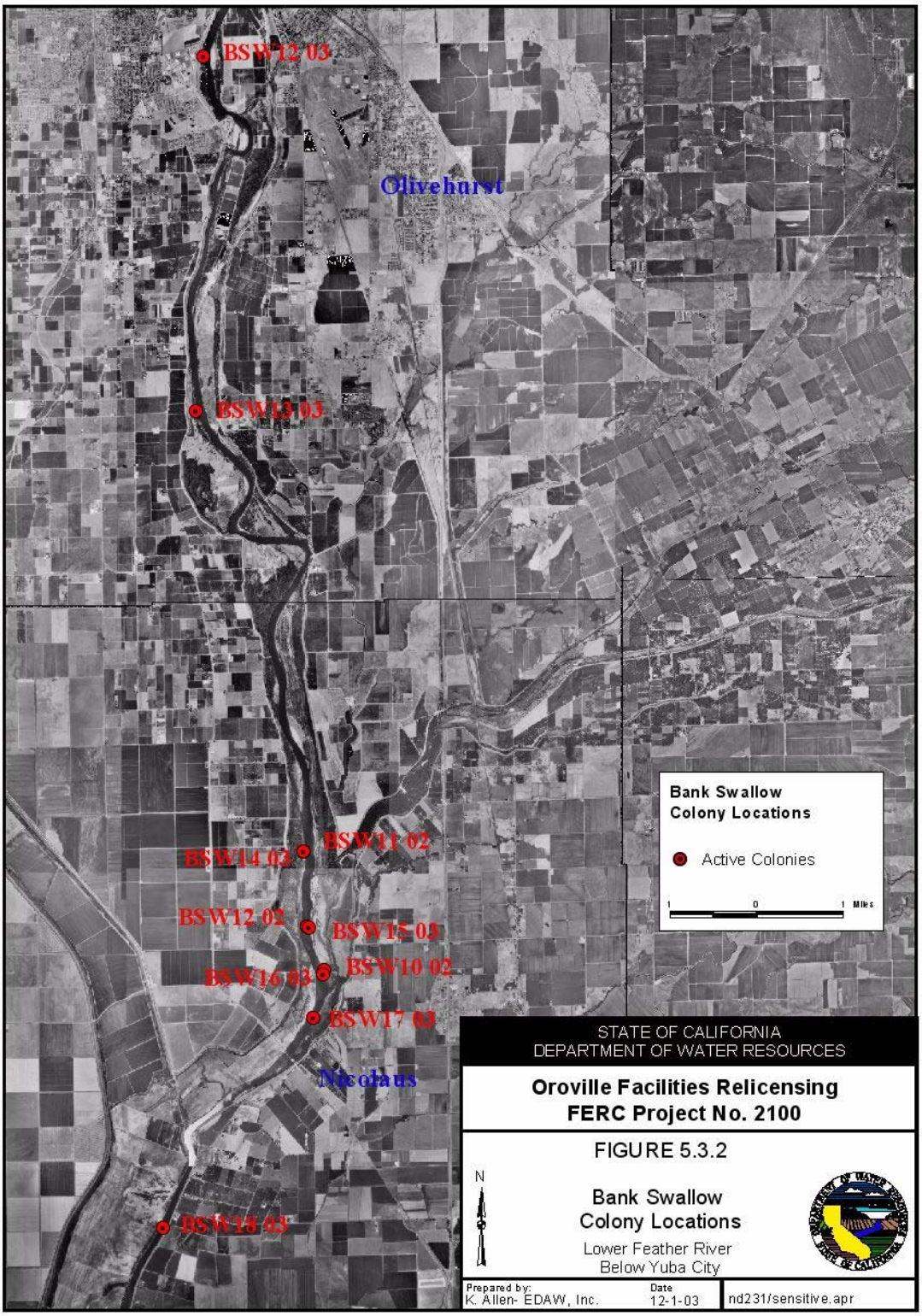

BSW12 03
Olivehurst
BSW13 03
BSW14 03
BSW11 02
BSW12 02
BSW15 03
BSW16 03
BSW10 02
BSW17 03
Nicolaus
BSW18 03
Bank Swallow
Colony Locations
Active Colonies
1 0 1 Miles
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities Relicensing
FERC Project No. 2100
FIGURE 5.3.2
N
Bank Swallow
Colony Locations
Lower Feather River
Below Yuba City
Prepared by:
K. Allen- EDAW, Inc.
Date
12-1-03
nd231/sensitive.apr

The project also has the potential to impact bank swallow production through water supply operations. Bank swallows are a migratory species and begin to arrive back on the Feather River in late March and early April, with the bulk of the birds arriving in late April and early May (Garrison 2001). Juveniles begin to disperse from the nest colonies around mid-June and early July and are absent from the nest colonies by mid-July (Garrison 2001). Excluding uncommon spring emergency flood releases, project operations historically have resulted in relatively low flows (<2500 cfs releases) during April, May and June. However, water supply deliveries frequently result in much higher releases during July (>9,000 cfs). Historic data indicate that July pre-project flows of 9,000 cfs did not occur. However, pre-project flows in this range occurred about 14 percent of the time during June.

To evaluate the potential for project-related inundation of pre-fledged nestlings, stage discharge relationships were modeled for each 2003 active colony locations. These stage/discharge relationships were compared to the elevation of the lowest burrow in each colony with a 1-foot buffer (Figures 5.3.3 through 5.3.17). This modeling indicates that 2003 project operations during early July have the potential to inundate at least a portion of nine of the fifteen active colonies while pre-fledged young are potentially present within the nest burrows. However, it is currently unknown if any of the potentially inundated burrows contained nestlings at the time of inundation. This modeling does not take into account potential losses related to flow induced bank collapse or saturation which could also potentially induce losses of adults and pre-fledged young. Based on these modeling results, DWR initiated consultation with DFG to further evaluate potential losses and develop protection, mitigation, or enhancement measures.

Projected flow increases in July under the OCAP 2020 South Delta Implementation Program scenario of 400 to 800 cfs (depending on water year type) could result in increased potential for take of bank swallows over and above any current losses as they could result in a higher percentage of the burrows being flooded prior to fledging. Projected flow increases in July under the OCAP future 2020 EWA scenario would further exacerbate this potential problem with SWP project releases increasing by as much as 1400 cfs over current conditions. These increased July future EWA flows could increase river stage an additional 1.5 feet at some bank swallow colony locations. Further, the OCAP proposes to continue the existing operational pattern of relatively low flows throughout the majority of the bank swallow nesting cycle (allows burrow excavation and nesting on the lower portions of eroding river banks) followed by significant increases in stream flow and water surface elevation at the end of the nesting season.

Figure 5.3.3. 2003 stage/discharge relationship at bank swallow colony #1 - RM 54.95

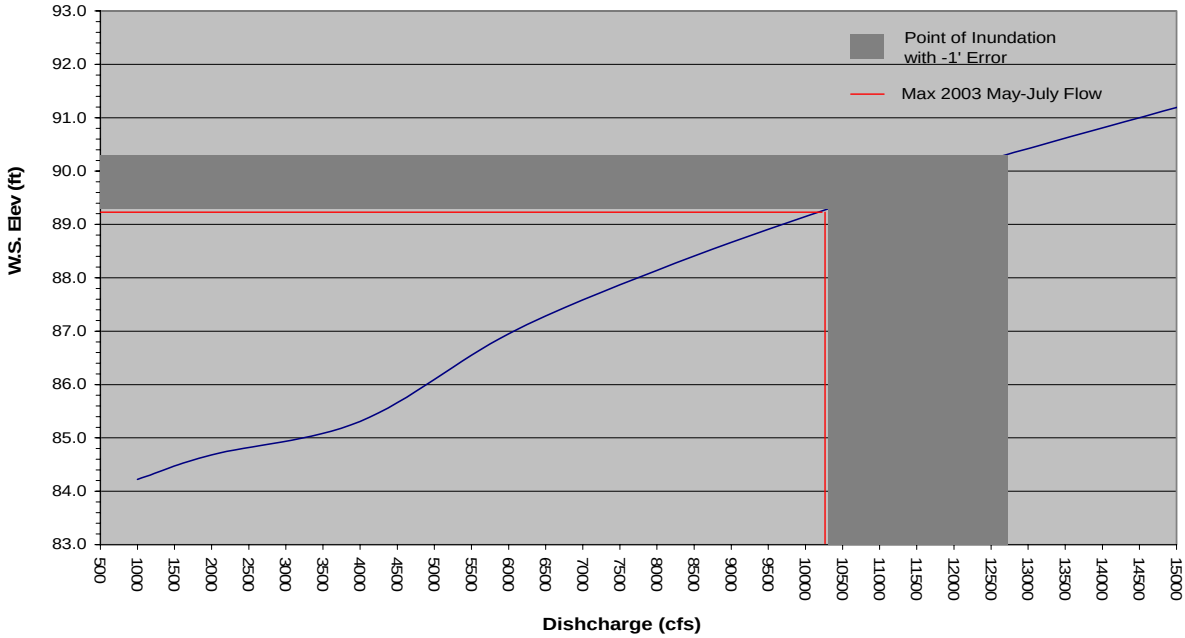


Figure 5.3.4. 2003 stage/discharge relationship at bank swallow colony #4- RM 45.05

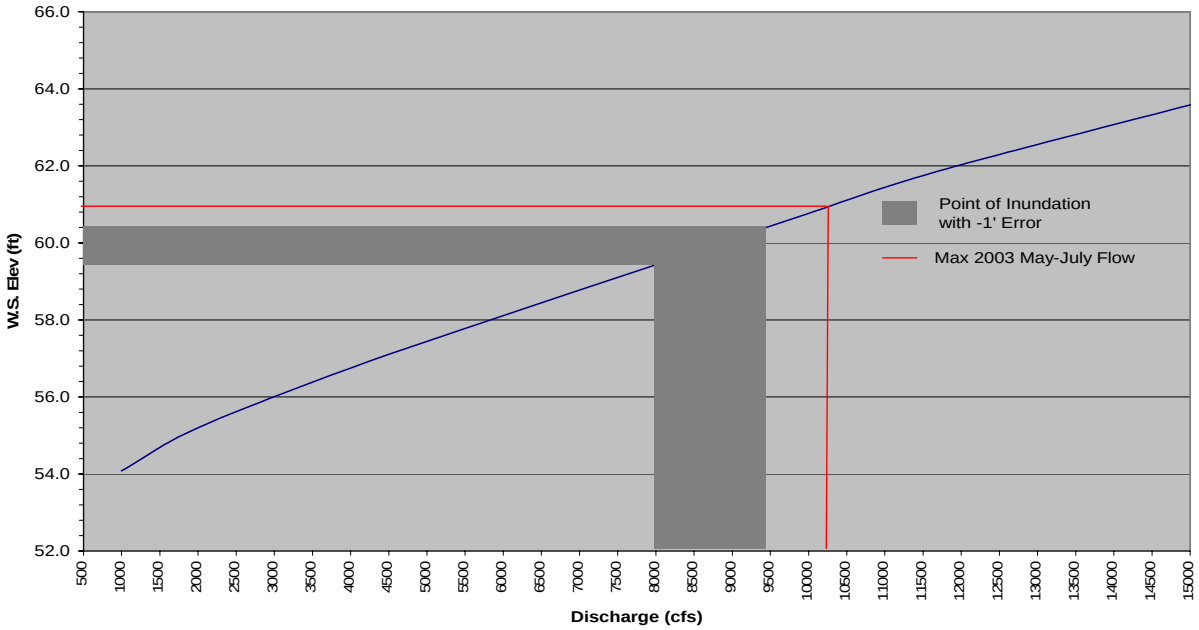


Figure 5.3.5. 2003 stage/discharge relationship at bank swallow colony #5 - RM 44.5

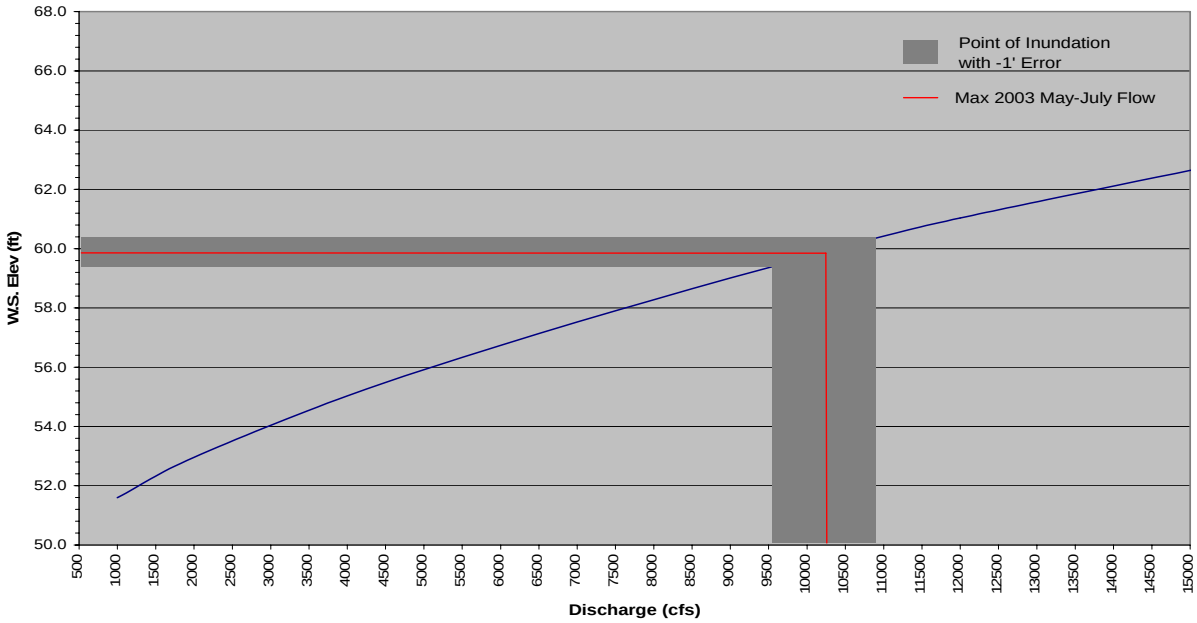


Figure 5.3.6. 2003 stage/discharge relationship at bank swallow colony #7 - RM 40.5

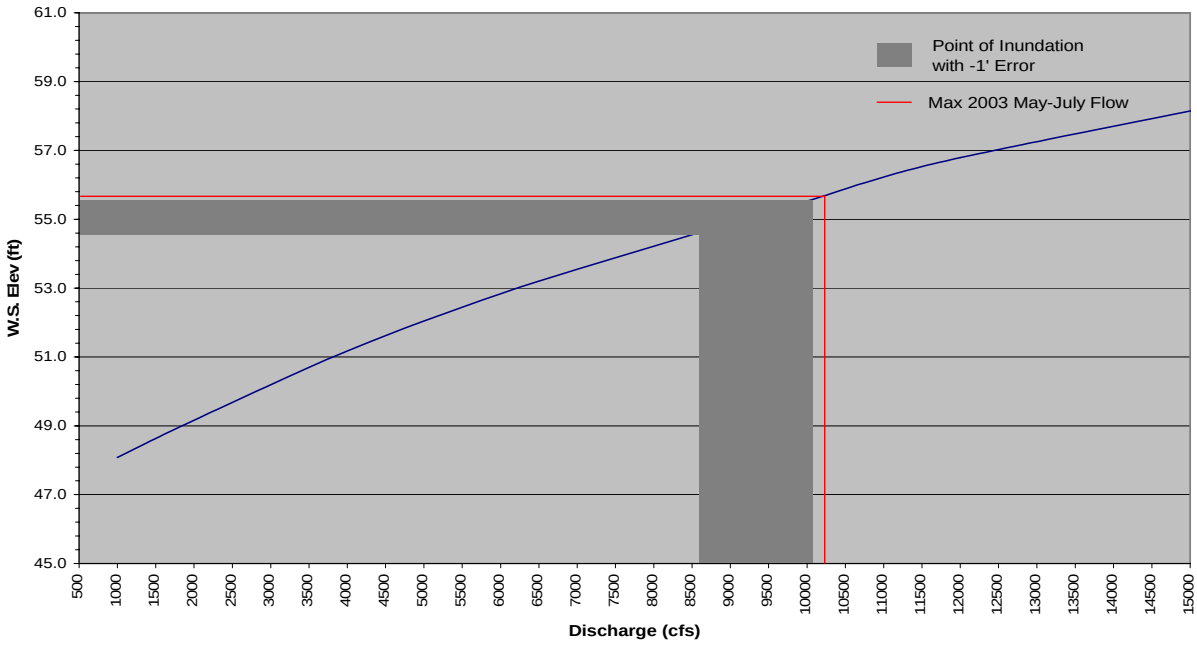


Figure 5.3.7. 2003 stage/discharge relationship at bank swallow colony #8- RM 40.4

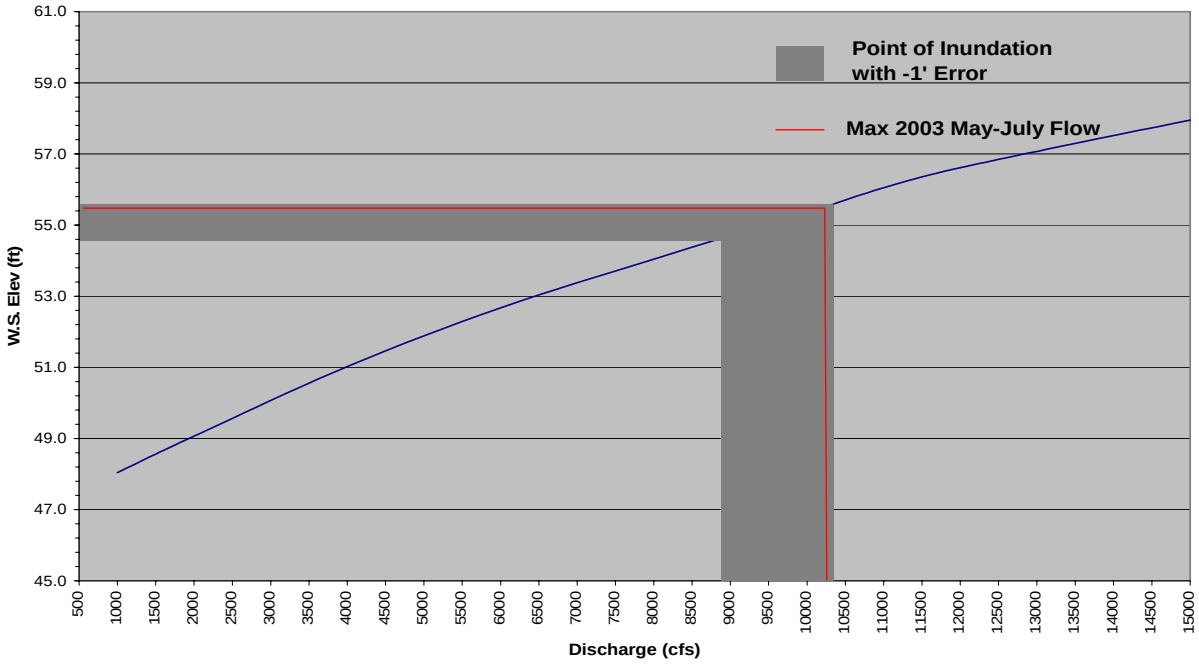


Figure 5.3.8. 2003 stage/discharge relationship at Bank Swallow Colony #9 - RM 35.6

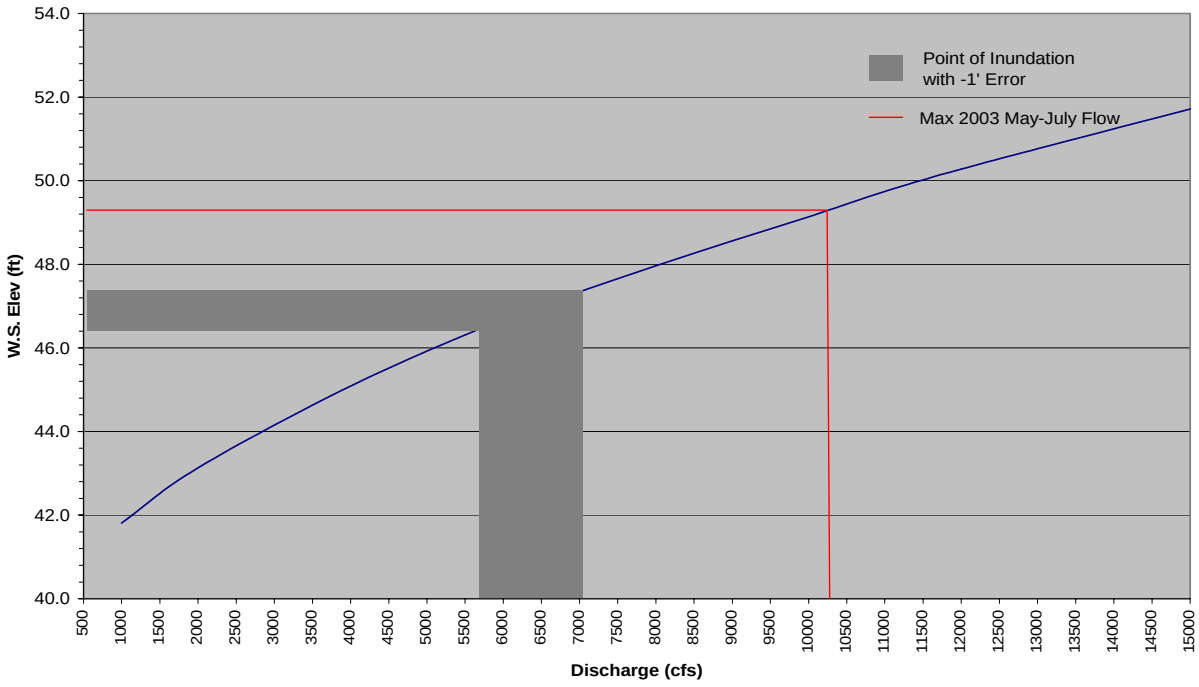


Figure 5.3.9. 2003 stage discharge relationship at bank swallow colony #10- RM 34.5

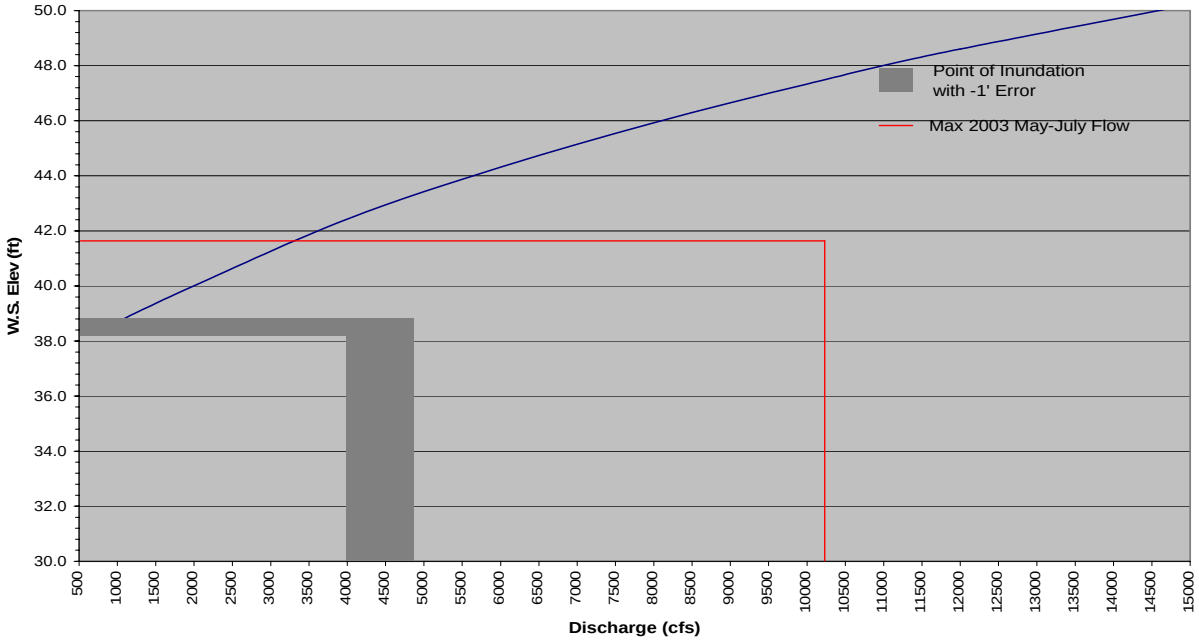


Figure 5.3.10. 2003 stage/discharge relationship at bank swallow colony #11 - RM 34.15

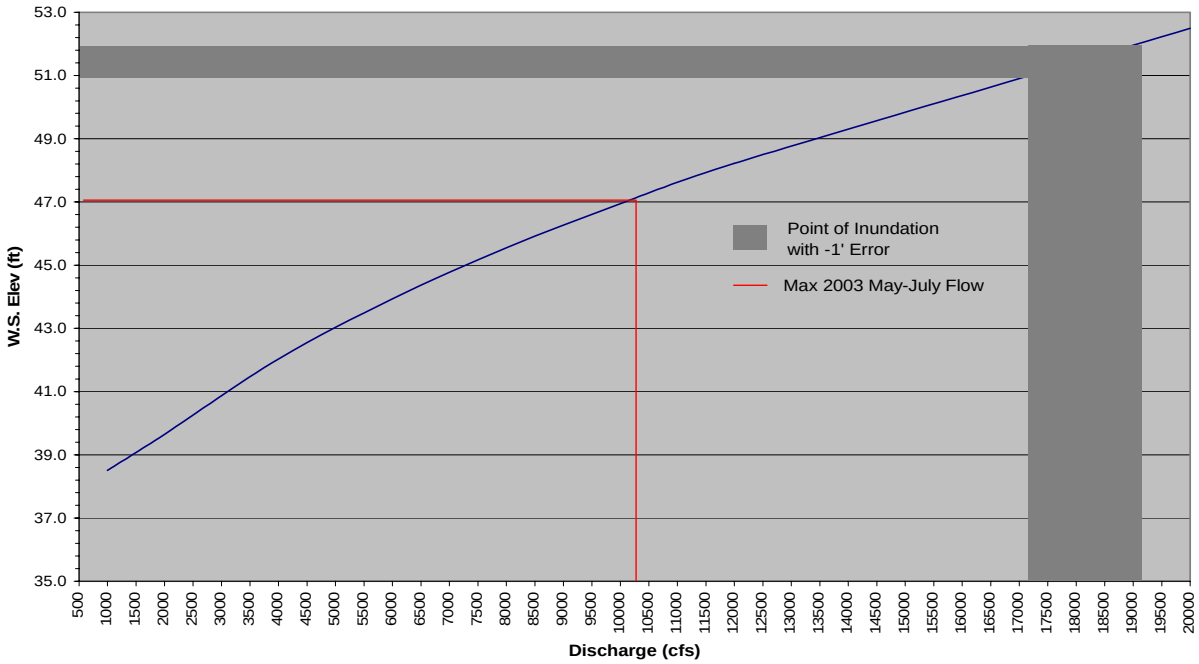


Figure 5.3.11. 2003 stage/discharge relationship at bank swallow colony #12 - RM 26.1

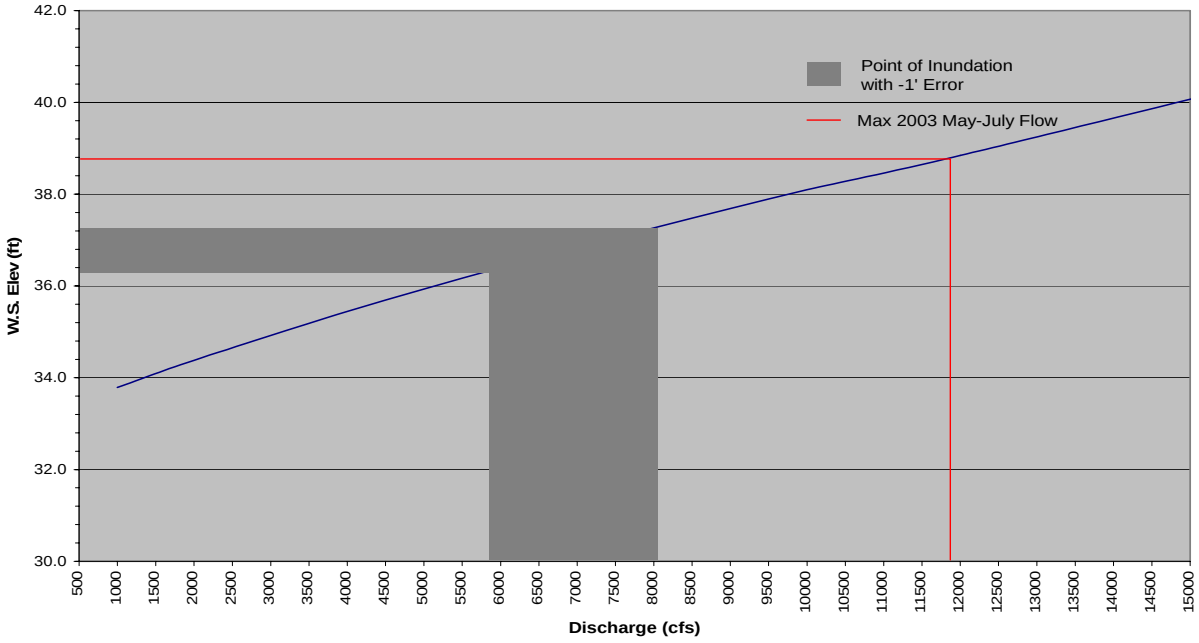


Figure 5.3.12. 2003 stage/discharge relationship at bank swallow colony #13 - RM 20.45

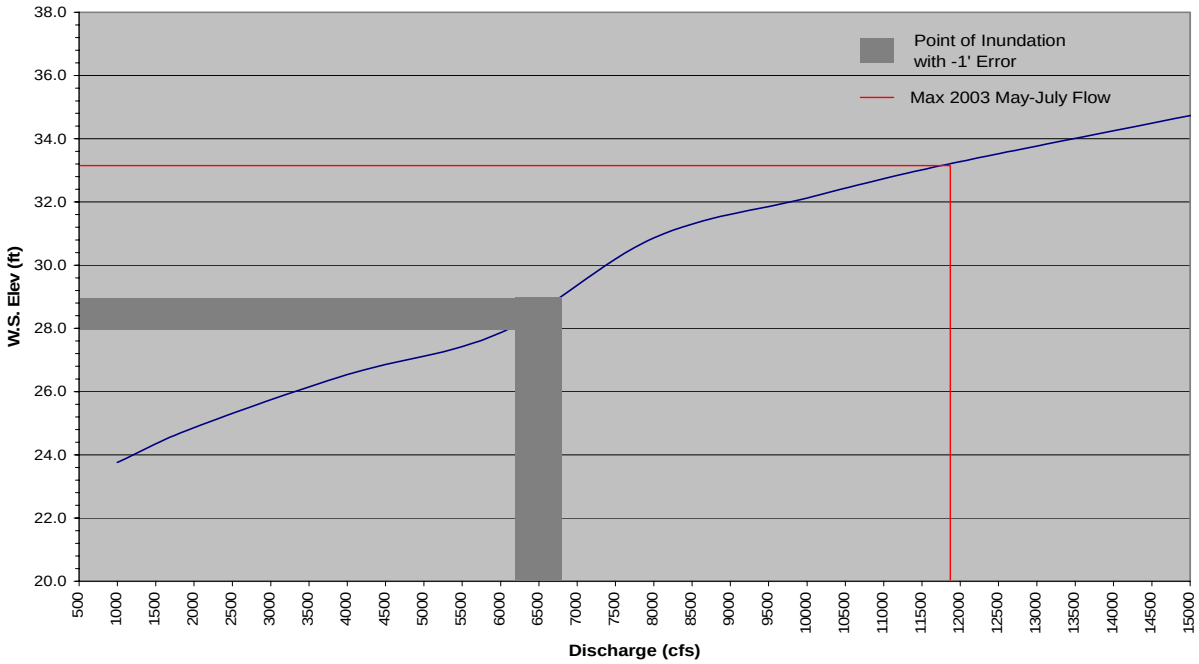


Figure 5.3.13. 2003 stage/discharge relationship at bank swallow colony #14 - RM 12.3

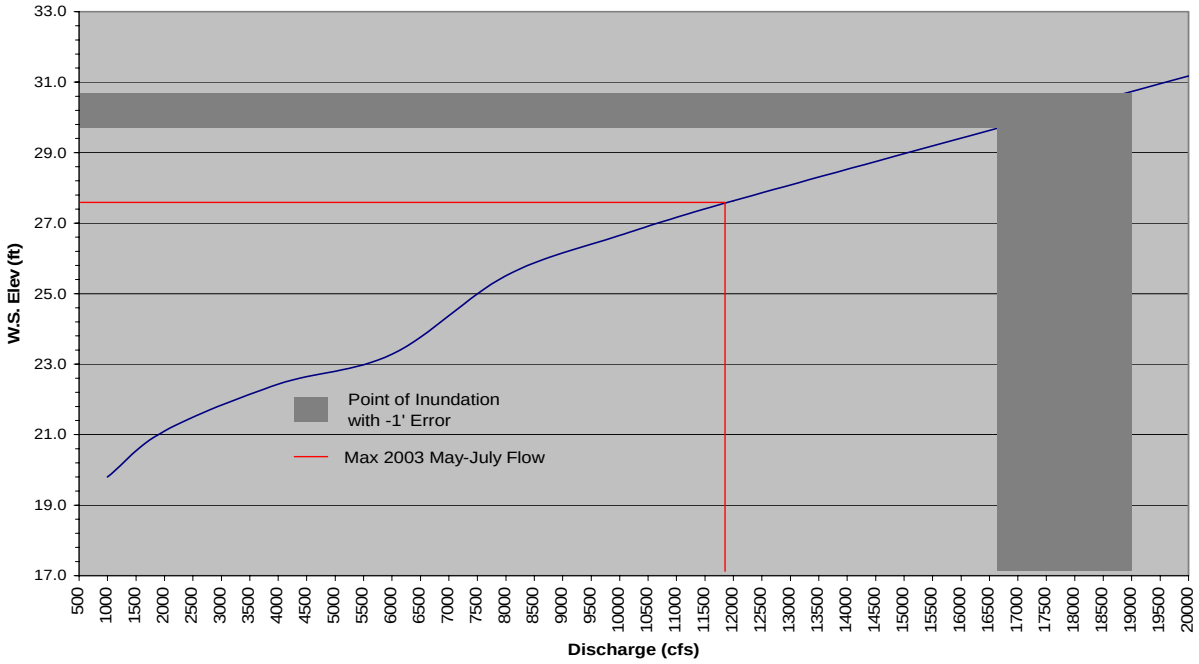


Figure 5.3.14. 2003 stage/discharge relationship at bank swallow colony #15 - RM 11.2

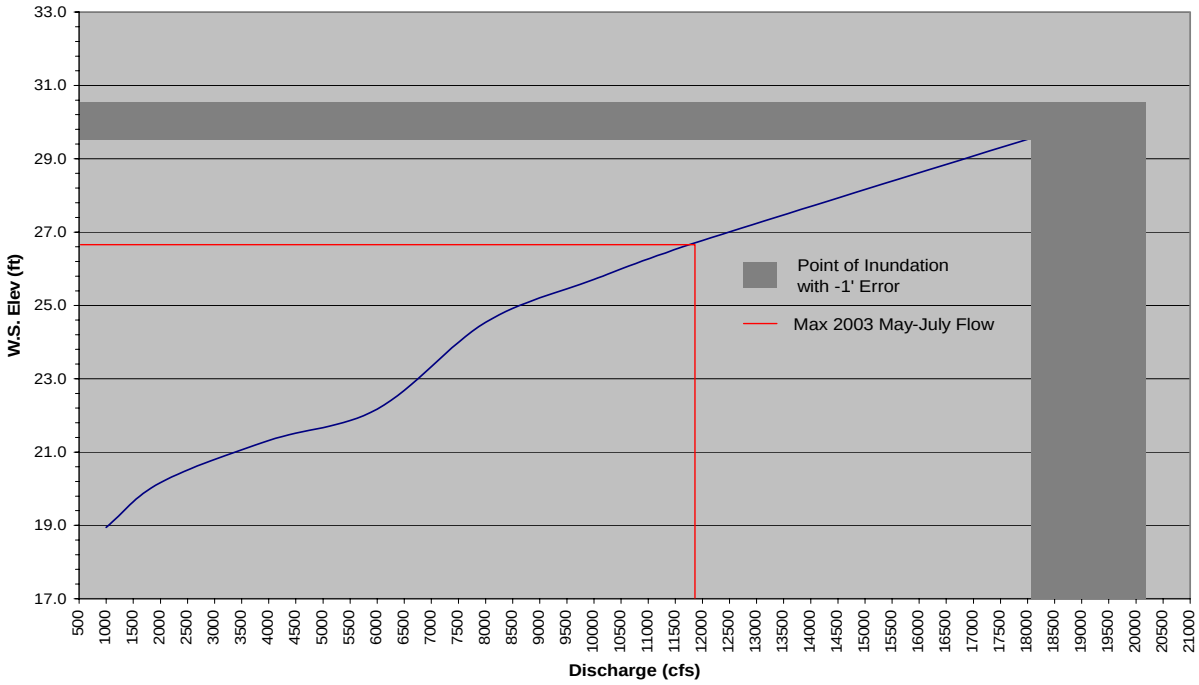


Figure 5.3.15. 2003 stage/discharge relationship at bank swallow colony #16 - RM 10.5

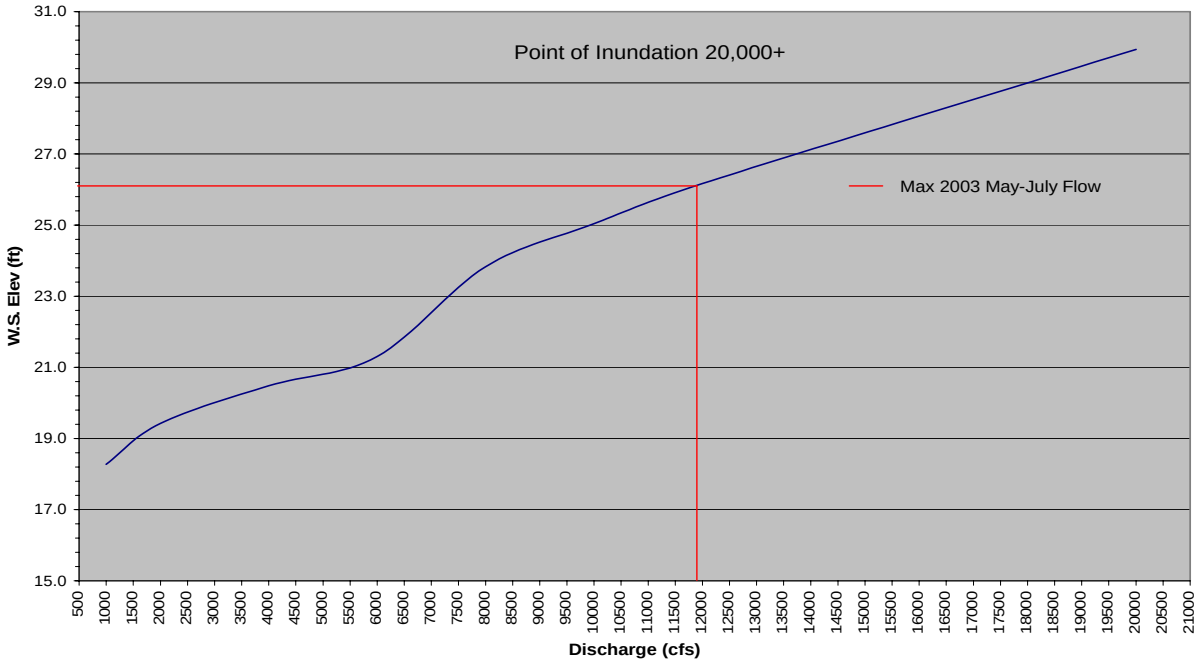


Figure 5.3.16. 2003 stage/discharge relationship at bank swallow colony #17 - RM 9.9

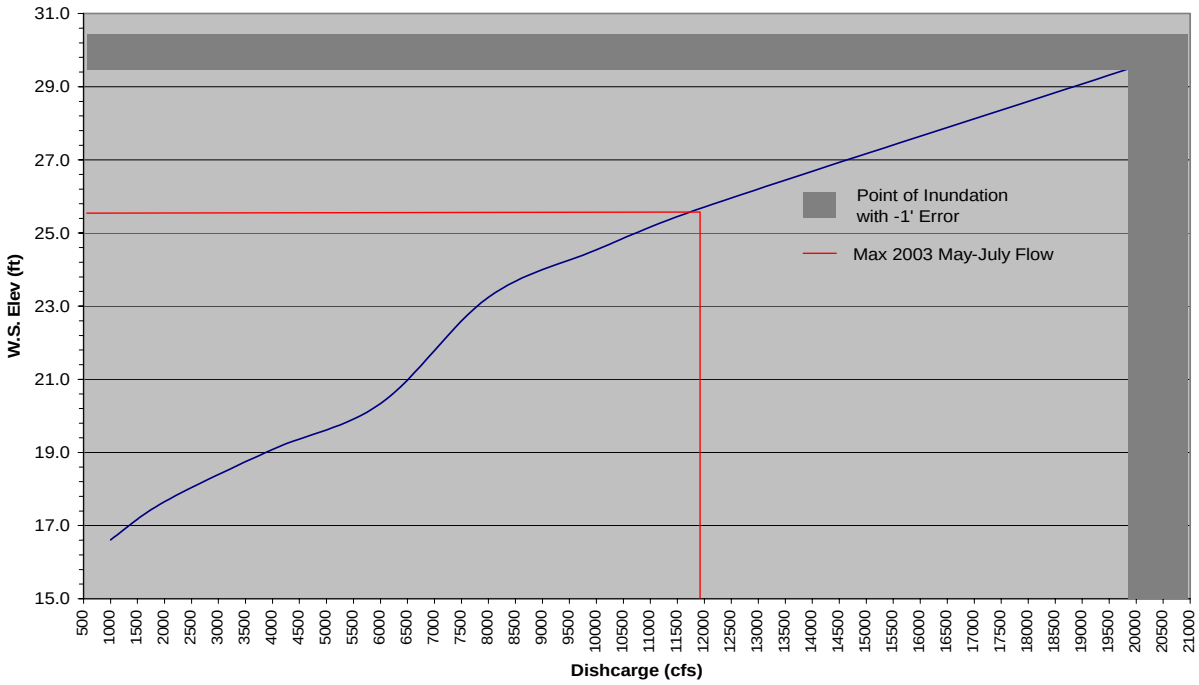
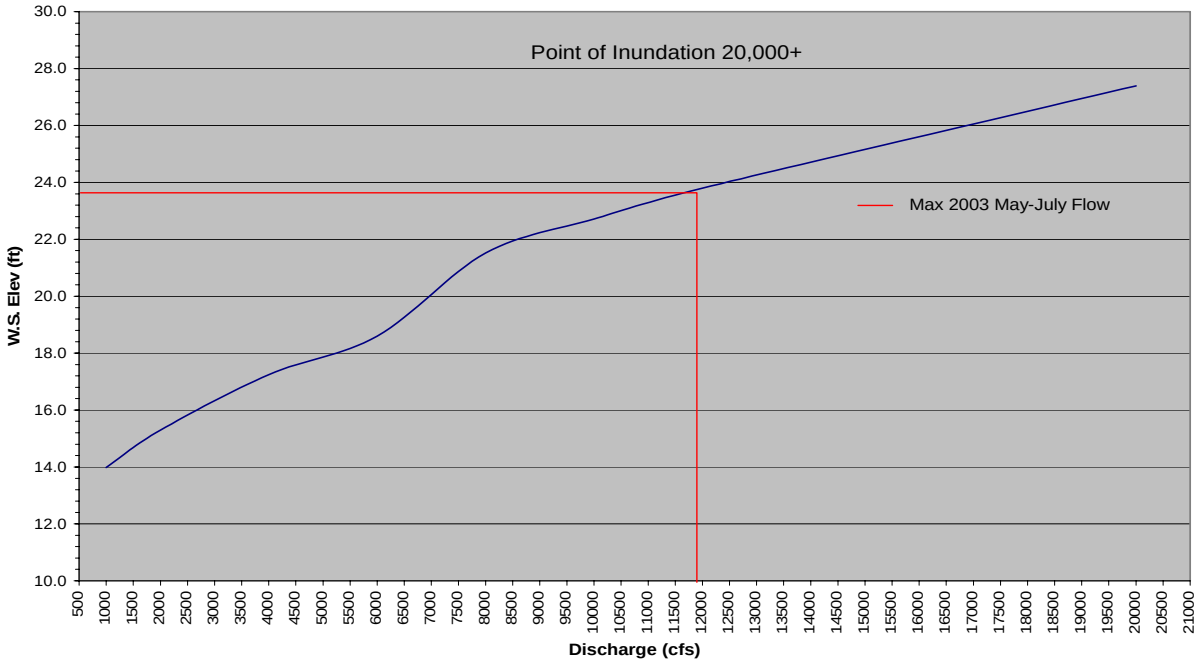


Figure 5.3.17. 2003 stage/discharge relationship at bank swallow colony #18 - RM 5.95



5.4 GRAVEL HARVEST

Gravel harvest currently occurs within the portion of the OWA, which straddles the Feather River. This area was mined for gold during the early 1900s. As a result, significant dredging and hydraulic mining left the area with many medium to large ponds (dredger ponds) and mounds of gravel/cobble. Nature began to reclaim this area in the early to mid-1900s. In the early 1960s, the area was again mined heavily, this time for material to build Oroville Dam. Large amounts of clay, gravel, cobble, and boulders were taken from the area and deposited in the dam. Again, this resulted in significant changes to the topography and vegetation communities. These topographical changes, primarily removal of large unvegetated dredger piles on the portion of the OWA south of the Feather River during project construction has resulted in increased wetland and riparian habitat which supports a large and diverse wildlife population.

Barren gravel/cobble piles currently exist on approximately 615 acres within the OWA. The free draining nature of these dredger tailings and distance to groundwater precludes the establishment of vegetation except in areas at elevations near the water table. These largely barren areas have been subject to gravel harvest during project construction and are a continuing source of gravel for project maintenance. Further, large scale, commercial gravel harvest activities currently occur within portions of the OWA through a mining lease under the jurisdiction of DWR. While this commercial gravel lease is administered by DWR, it evolved from a land transfer between DFG and local commercial gravel interests (Maria Chin, DWR Land and Right-of-Way, personnel communication).

DWR maintains numerous contracts with local companies for the mining and use of gravel within the OWA. These areas are all located within the floodplain of the Feather River and provide significant gravel resources for projects throughout the surrounding area of the county. There are current contracts for gravel mining with the following companies:

Granite Construction;

Matthews Ready Mix;

Joint Water Board;

City of Gridley and City of Biggs; and

Sutter/DWR Yard.

Potential wildlife impacts associated with gravel extraction and transportation include noise, dust, disturbance, direct mortality, and habitat modification/loss. For these reasons and others, DFG and other stakeholders have questioned the compatibility of commercial gravel harvest and wildlife management within a designated State Wildlife Management Area. While this issue is primarily a land use/land management issue, it is briefly explored in this report as potential wildlife impacts and benefits can occur.

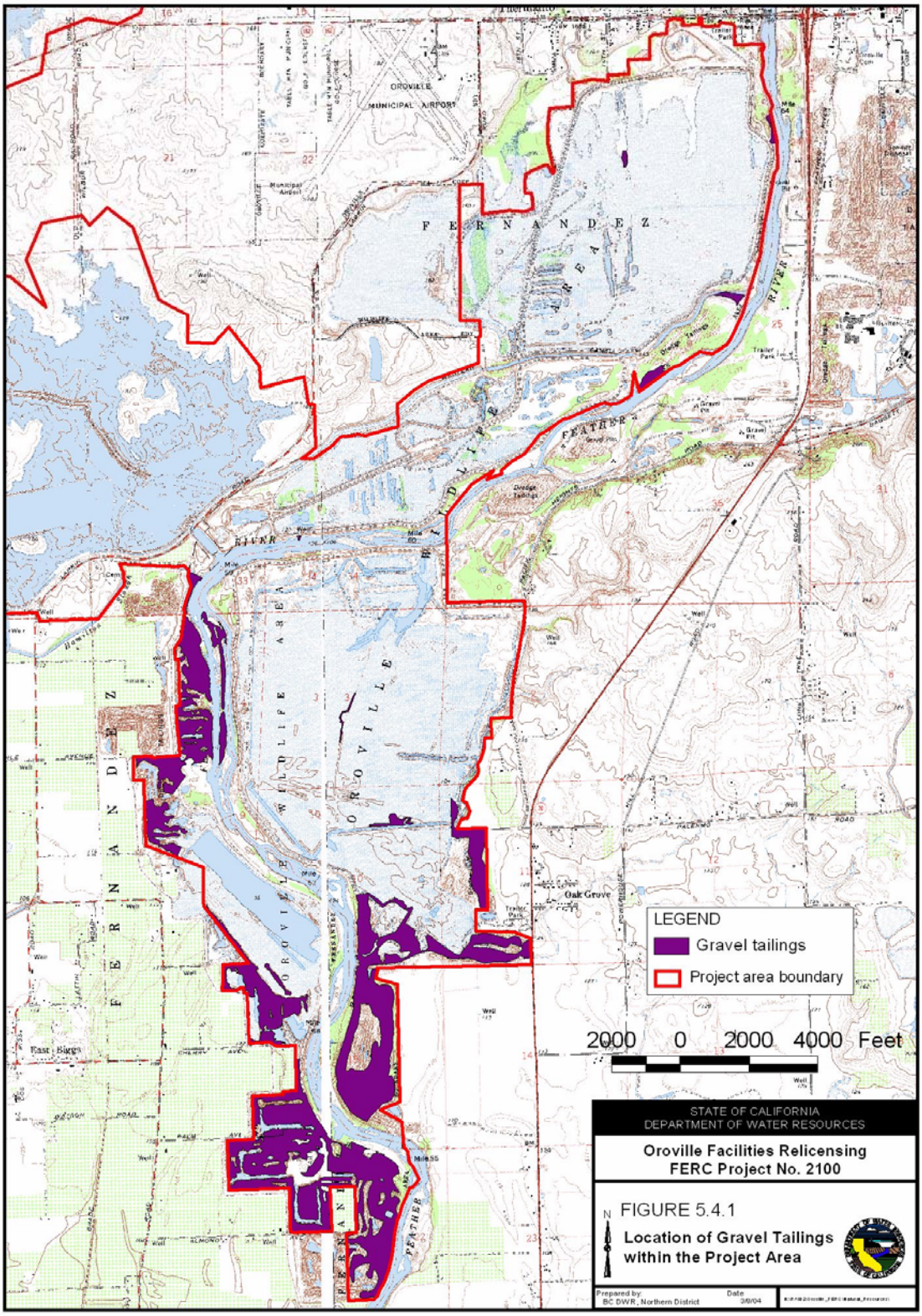
CWHR predicts that barren habitats are required for a total of 17 wildlife species, while 82 wildlife species in Butte County may utilize this habitat type at some point in their life cycle. CWHR modeling predicts that up to 163 wildlife species utilize freshwater emergent habitats within Butte County (SP-T4 Appendix A). Further, CWHR predicts that up to 112 wildlife species could utilize lacustrine habitat within Butte County (SP-T4 Appendix A). From a wildlife habitat perspective, carefully designed and implemented gravel harvest within the OWA may well be the only effective large-scale, long-term habitat improvement tool available to land managers. Large areas of exposed dredger tailings provide essential habitat for few wildlife species and can act as a barrier to dispersal and movement of some species. Gravel extraction serves to remove larger material while retaining fine materials (sand and silt) necessary for vegetative establishment. Gravel harvest can also effectively decrease the distance to groundwater to levels suitable for vegetative establishment and maintenance. Carefully managed gravel harvest can in the long-term replace the existing 615 acres of relatively barren dredger tailings within the OWA (Figure 5.4.1) with riparian, freshwater emergent wetland, and lacustrine habitat of higher wildlife value. Further, gravel replenishment within the Feather River floodplain has the potential to improve fisheries habitat including recovery of State and federally "listed" salmon and steelhead.

DWR in cooperation with the California Department of Conservation (DOC), DFG, USF&WS, and the commercial and local mining interests will continue to evaluate opportunities to minimize impacts to wildlife and wildlife habitat while maximizing potential benefits associated with gravel harvest within the OWA. These efforts may include improved interagency reclamation planning and design, improved environmental review, and development of a long-term habitat restoration plan.

5.5 PROJECT RELATED MAINTENANCE ACTIVITIES

Project area land management agencies including DWR, DFG, and DPR conduct a wide variety of maintenance activities within the project area. Land Management agencies maintenance staff were interviewed to identify maintenance activities, locations, and timing. Some of these activities have the potential to directly affect wildlife species and wildlife habitat. Maintenance activities with the greatest potential to affect wildlife species or wildlife habitat are discussed below.

5.5.1 Road, Trail, and Parking Lot Maintenance-GIS data analyses identify about 870 acres of roads and 90 acres of trails in the project area. Maintenance activities associated with roads and parking areas vary as to the type of base (dirt, gravel, paved). In general, road maintenance consists of maintaining the road base, controlling vegetation along roadsides, and cleaning ditches and culverts to insure drainage. Dirt and gravel road bases are primarily maintained by grading (spring and


OROVILLE
MUNICIPAL AIRPORT
F E R N A N D E Z
A R E A
FEATHER
RIVER
WILDLIFE AREA
OROVILLE
Oak Grove
East Biggs
LEGEND
Gravel tailings
Project area boundary
2000 0 2000 4000 Feet
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities Relicensing
FERC Project No. 2100
FIGURE 5.4.1
Location of Gravel Tailings
within the Project Area
N
Prepared by
BC DWR, Northern District
Date
9/8/04

fall/winter). However, herbicide treatments are infrequently used to supplement grading in some locations. Paved road bases are repaved on approximately 10-year intervals. The amount of roadside vegetation treatment varies by type of road and use standard. Along high-speed roads mowing or herbicide is used on an annual basis to control herbaceous vegetation on the shoulder of the road and on trails. Further, along these roads woody vegetation is often mechanically removed to improve site distances and public safety.

Road maintenance activities have the potential to adversely affect federally listed vernal pool plant and animal species, as well as, the federally listed VELB. Habitat surveys indicate that approximately 80 percent of the vernal pools within the project area are associated with physical structures, primarily roads. Analyses of each of the 230 vernal pools within the project area identified some opportunities to improve road maintenance practices in areas containing vernal pools. Elderberry bushes, the primary habitat for the VELB, occur primarily along the Feather River below Oroville Dam. High elderberry densities are associated with levee roads within the portion of the OWA along the Feather River. To avoid potential impacts, all elderberry bushes within 100 feet of roads and other project facilities are mapped using GPS technology. These data/maps allow maintenance staff to identify and avoid locations where ground disturbance, herbicide treatment or woody vegetation removal would be restricted. Additional vernal pool and elderberry conservation measures are likely to be identified within the ESA Section 7 consultation process

An evaluation of existing barren or degraded upland habitats will be conducted under SP-T10 for the purpose of identifying unnecessary roads and other areas of habitat disturbances suitable for upland site restoration.

5.5.2 Bridge Maintenance A large variety of bridges are present within the project area ranging from small wooden structures on trails to State Highway bridges spanning Lake Oroville. Maintenance activities associated with bridges primarily include safety inspection, repainting, and redecking.

Repainting has the greatest potential to impact wildlife. Larger bridges within the project area have the potential to support nesting sensitive raptors, cliff swallows, rock doves, house sparrows, barn owls, and up to 15 species of bats. Repainting large bridges generally occurs during the dry season (to limit discharge of hazardous material into waters) and has the potential to disrupt wildlife reproduction. Historic practices to limit impacts include timing (sandblasting and repainting outside the reproductive season) and/or pre-project screening to exclude wildlife from work areas. Bridge inspection also has the potential to adversely impact nesting sensitive raptors by disturbance. Human disturbance can adversely affect nesting success by displacing incubating adults, or prefledged young from the nest site. Maintenance staff are notified of sensitive raptors nesting locations, response to disturbance, and the breeding season (March through August) to prevent disturbance of nesting raptors.

5.5.3 Pesticide Use Pesticides are one management tool used at several locations to control undesirable rodents, insects, and vegetation. Ground squirrel control is practiced by DWR along the Forebay and Afterbay levees using bait stations to limit non-target and secondary species poisoning. Neither DPR nor DFG conduct any vertebrate pest control employing chemicals on a regular basis. Butte County Mosquito Abatement Department and the City of Oroville annually treat substantial areas within the project area for mosquito abatement.

All three of the principal land management agencies (DWR, DFG, and DPR) utilize herbicides to control vegetation at specific locations for specific purposes including fuels management, noxious weed control, public safety, and to allow facilities inspection. Roadside spraying is the largest amount of area treated on an annual basis. However, the Thermalito Afterbay and Forebay Dams are sprayed on an annual basis to facilitate structural integrity inspections. DPR spot treats noxious weeds along the wetland edge of the Thermalito Forebay, while aerial spraying for purple loosestrife control has been conducted by DFG along portions of the Thermalito Afterbay margin. All three land management agencies have licensed pesticide applicators who fully comply with safety, application criteria, and reporting requirements.

The principal wildlife associated impacts related to pesticide use include potential impacts to vernal pool invertebrates and VELB. Both Thermalito Afterbay and Forebay levees and associated roads are located near vernal pools. Some purple loosestrife treatment areas are also close to vernal pool or giant garter snake habitats. Preliminary estimates indicate that thousands of elderberry stems are present within 100 feet of project roads within the portion of the OWA near the Feather River. Maps identifying the locations of all vernal pool habitats and elderberry shrubs are being distributed to maintenance staff associated with DFG, DWR, CALTRANS, Butte County Mosquito Abatement, and DPR, which should facilitate avoidance of these sensitive habitats during maintenance activities.

5.5.4 Transmission Line Right-of-Way Approximately 11.3 miles of overhead transmission lines are included in the project license and require regular trimming of trees to maintain vegetation clearances. These transmission lines include:

- The BUS line, a 230-kV overhead transmission line extending 9 miles from the Hyatt Powerplant Switchyard to PG&E's Table Mountain Substation.

- A 230-kV overhead transmission line that extends approximately 2.3 miles from the Thermalito Switchyard to PG&E's Table Mountain Substation.

The majority of the transmission line corridor is located in annual grassland habitats, which do not require vegetative treatment or other regular maintenance activity other than inspection. However, the BUS line crosses oak and foothill pine habitats between

the Hyatt Switchyard and south Table Mountain. In keeping with the conditions of the existing license, DWR maintains woody vegetation within the transmission line corridor to reduce fire danger. Vegetative control includes pruning or topping trees within 30 feet of transmission lines using mechanical methods. Slash is piled to provide wildlife cover. A largely unmaintained access road/jeep trail is present along portions of the transmission line corridor.

Reduced habitat structural diversity in areas subject to mechanical treatment can influence wildlife species diversity, primarily avian species diversity that is strongly influenced by habitat structural diversity. Avian species requiring multi-storied stands or large snags may be adversely impacted within those portions of the transmission line corridor subject to woody vegetation management.

A small number of elderberry shrubs are present within the transmission line right-of-way. Although these shrubs do not reach a height which requires topping, they could be impacted by removal of overstory, or mechanical damage associated with overstory removal. Evaluation of these potential ESA impacts will be explored under the federal ESA Section 7 consultation process.

At least three active osprey nests are present on transmission towers along the transmission line corridor. Two of the three active nests successfully produced young during the 2002 breeding season. These nest locations are near the transmission line crossing of the Diversion Pool. Mechanical treatment within this portion of the transmission line corridor should be scheduled outside the osprey nesting season (April through August). Further, any activities involving human access to the upper portions of these transmission line towers (excluding emergencies) should be avoided during the osprey nesting season to limit disturbance during incubation or to pre-fledged young.

5.6 EVALUATION OF DIRECT AND INDIRECT HABITAT LOSSES

Table 5.6.1 summarizes the evaluation of direct and indirect wildlife habitat loss by project feature category. For the purposes of these analyses, habitat losses related to inundation are considered type conversions rather direct or indirect habitat losses. However it is important to realize that this type conversion represents the greatest amount of project related wildlife habitat alteration, exceeding 20,000 acres.

Project features with primarily low levels of indirect wildlife habitat loss occupy about 4,100 acres or 10 percent of the project area. Project features resulting in moderate levels of both direct and indirect habitat total about 900 acres or about two percent of the project area. While project features resulting in direct loss of wildlife habitat currently occupy about 1,200 acres or about three percent of the project area.

Additional direct and indirect habitat losses may occur resulting from implementation of Relicensing Resource Actions. To the extent possible additional habitat loss or

degradation should be avoided particularly in the portion of the project area managed as a State Wildlife Area. Relicensing stakeholders should be aware of the trade-offs associated with additional recreational developments and long-term maintenance of wildlife habitat.

Table 5.6.1 Direct and Indirect Wildlife Habitat Losses Associated with Categories of Project Facilities

Facility Category	Number of Polygons	Acreage	Habitat Loss Classification
Habitat Improvement	26	87.15	indirect-low impact
Recreation General	198	3,923.25	Indirect-low impact
Transmission Lines	191	76.11	Indirect-low impact
Cemetery	8	6.49	Indirect-low impact
Subtotal	**423**	**4,093.00**	
Miscellaneous Disturbed	165	647.67	direct & indirect-moderate impact
Recreation Campground	47	73.07	direct & indirect-moderate impact
Recreation Day Use	82	99.22	direct & indirect-moderate impact
Recreation Facilities	21	8.16	direct & indirect-moderate impacts
Recreation Trails	778	87.54	direct & indirect-moderate impacts
Subtotal	**1093**	**915.66**	
Facilities	285	292.69	direct-high impact
Recreation Boating Facilities	137	80.22	direct-high impact
Roads	1,137	867.84	direct-high impact
Subtotal	**1559**	**1,240.75**	
Total	**3075**	**6,249.4**	

6.0 ANALYSES

6.1 WATER LEVEL FLUCTUATIONS-LAKE OROVILLE

Existing wildlife use of the Lake Oroville drawdown zone is extremely limited as relatively few wildlife species are adapted to barren habitats. Establishment of additional vegetation within the drawdown zone of Lake Oroville is desirable from a wildlife habitat perspective. Previous attempts to revegetate the drawdown zone have been at least partially successful in carefully selected locations. Revegetation locations are most likely to be successful if they:

- minimize the period of inundation (upper 50 feet of the drawdown zone)
- contain pockets of soil or fine materials at least 2 to 3 feet in depth
- contain springs or seeps or an existing irrigation source
- located on northern or eastern exposures
- located away from areas of high shoreline recreation use

Areas meeting all of these criteria are extremely limited on Lake Oroville. Revegetation of the drawdown zone for wildlife habitat improvement while desirable, is practical (without summer irrigation) only at a few selected locations.

U. S. Bureau of Reclamation studies at Shasta Reservoir indicate bald eagle productivity is positively correlated with spring reservoir water surface elevations Insufficient data currently exists to determine if Lake Oroville water levels affect bald eagle productivity in a similar manner. Annual monitoring of bald eagle reproduction to allow long-term trend assessment has been identified as a potential conservation measure in the Federal ESA Section 7 consultation process.

6.2 WATER LEVEL FLUCTUATIONS-DIVERSION POOL, THERMALITO FOREBAY, AND THERMALITO AFTERBAY

Experimental spring 2003 Afterbay water surface elevation fluctuations successfully avoided take of waterfowl nests and eggs associated with flooding without significant impacts to power generation or operational flexibility. However, stakeholders have suggested that forcing hens to nest in upland areas with less nesting cover than within the wetland margin could lead to higher predation losses. 2003 survey of nest cover enhancements indicate that nest densities of up to 10 nests/acre can occur. However, some nest cover enhancement plots with excellent nesting cover had little or no waterfowl nesting use. These conflicting results indicate that additional testing and evaluation are required to identify the location and microhabitat conditions that nesting waterfowl are keying in on.

Waterfowl brood ponds constructed within inlets of the Afterbay are not subject to the water level fluctuations experienced in the Afterbay. These areas provide a refuge for wildlife species and critical life stages of wildlife species potentially affected by Afterbay water level fluctuation including giant garter snake and waterfowl broods.

6.3 FEATHER RIVER FLOW FLUCTUATIONS

6.3.1 Bank Swallows

Nesting bank swallows are the wildlife species most likely to be impacted by changes in Feather River hydrology as even relatively minor changes in project releases during the spring breeding season have the potential to adversely impact production through flooding of eggs or nests.

Bank swallow nesting does not occur at the same locations every year. Likewise, height of the burrows above the water and breeding chronology are likely to vary from year to year and between colonies. Smaller colonies appear to synchronize breeding so that egg laying, incubation, brooding, and fledging are all initiated and completed with little temporal variability (Barry Garrison, DFG, personnel. communication). Larger colonies exhibit greater temporal variability. Bank swallows in California are not known to produce more than one brood per nesting season. Impacts to nesting bank swallows are unlikely to occur after July 15th as long-term monitoring on the Sacramento River by DFG indicate that virtually all nestlings have fledged by this date.

The greatest threat to bank swallow populations continues to be permanent loss of habitat related to bank protection measures. Protection of bank swallow nesting habitat, through conservation easements may be a better way to maintain bank swallow populations on the Feather River. Likewise, current project operations which result in bank erosion and natural geomorphic processes should be maintained in the future to create and maintain bank swallow nesting habitat.

6.3.2 Riparian Habitat

Periodic high flows expose bare mineral soils within the alluvial floodplain. These barren, yet moist soils are critical sites for colonization by cottonwoods. Fremont cottonwoods disperse their seeds in spring to early summer when historic flows would most likely be receding following the winter rains and during spring snowmelt. The germinating seeds are commonly found along point bars and other moist, exposed substrates within the alluvial floodplain. The soil must be moist throughout the early stages of seedling establishment and the rate of water table decline must not exceed the rate of root growth.

Water flow regulation from Oroville Dam has changed the natural flow patterns of the Feather River. Lower flood flows together with levee construction have greatly reduced

floodplain flooding, sediment deposition, and groundwater recharge. Typically, water releases are reduced dramatically following a high flow event to maintain water levels in Lake Oroville. If this occurs during the spring when cottonwood seeds have been released, and the water levels decline at a rate greater than root growth, the seedlings will die. Water levels are then raised during the summer months for water supply. In areas where seedlings have survived, there is the added risk of inundation during the critical summer growth period. Although cottonwoods can withstand flooding, they cannot withstand prolonged inundation.

Riparian habitat restoration of agricultural lands within flood control levees or nonagricultural lands within the project area could serve to minimize or mitigate currently unquantified project affects on riparian habitat.

6.4 GRAVEL HARVEST

Fisheries stakeholders and agencies have identified lack of gravel recruitment below Oroville Dam as a potential ongoing project related impact to spawning steelhead and salmon. Potential Resource Actions been developed to address this impact such as injecting spawning-sized gravels into the low-flow reach on a regular basis could be designed to meet a number of wildlife management goals including:

- removal of un-vegetated dredger tailings to allow natural revegetation by riparian species including nesting yellow-billed cuckoo
- over-excavation to create additional wetland habitats which could benefit wetland species including giant garter snake
- over-excavation at selected locations to reduce wetland fragmentation and improve connectivity which could benefit wetland species including giant garter snake
- create additional deep-water lacustrine habitats within the OWA
- eliminate barriers to movement and wildlife dispersal
- increase plant species and plant structural diversity within the OWA
- provide additional recreational opportunities including hunting and fishing
- provide a financial incentive for commercial gravel operators to develop modern reclamation planning

6.5 PROJECT RELATED MAINTENANCE ACTIVITIES

Most ongoing maintenance practices have minimal impacts to wildlife populations or wildlife habitats. However, opportunities for modification of certain maintenance practices to minimize or avoid impacts to State or federally listed species have been identified. These maintenance activities include:

- road, fuel break, drainage system, and fence maintenance practices to minimize impacts to vernal pool invertebrates or VELB

- current Butte County Mosquito Abatement practices in areas containing vernal pool habitats or VELB habitat
- rodent control practices within giant garter snake habitat
- herbicide use within or adjacent to vernal pool habitats, giant garter snake habitats or VELB habitats
- bridge maintenance affects on nesting peregrine falcons
- trail maintenance activities limitations within bald eagle nest territories
- vegetative control within transmission line corridor effects on VELB

Opportunities to improve maintenance practices to minimize and avoid potential impacts to State and federal ESA species habitats will be explored during ESA consultation with respective regulatory agencies. Modification of some, or all, of these potential maintenance practices is likely to be included in the Relicensing Biological Assessment.

6.6 EVALUATION OF DIRECT AND INDIRECT HABITAT LOSSES

Roads represent the single greatest amount of direct habitat loss within the project area. Several areas within the project area have been subject to road closures for resource protection or because the road segment was no longer needed for project management purposes. Additional opportunities for road closure and associated habitat restoration may be identified within Relicensing Study SP-T10.

Future indirect habitat losses related to disturbance/displacement of wildlife can best be avoided by limiting additional road and recreational developments. However, losses associated with additional road or recreational developments can be minimized through seasonal closures of recreation facilities during low visitor use periods, retention of screening vegetation during construction, development within areas of previous habitat loss or degradation, minimizing disturbance footprint, and avoidance of environmentally sensitive resource areas including areas where State or federally listed plant and animal species are present.

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